UC06, UC07 AND UC08 INTELLIGENT HOST ADAPTER

TECHNICAL MANUAL (MSCP/TMSCP COMPATIBLE)

EMULEX

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Section 1
GENERAL DESCRIPTION

1.1 Introduction

This manual is designed to help you install and use your UC07 or UC08 Intelligent Host Adapter. It assumes that you have some knowledge of hardware configuration, LSI-11 bus architecture and terminology, and interpretations of error messages and device register contents.

The contents of the nine sections and two appendices are described as follows:

- **Section 1 (General Description):** This section contains an overview of the UC07/08 Intelligent Host Adapter.
- **Section 2 (Controller Specifications):** This section contains the specifications for the UC07/08 Host Adapter.
- **Section 3 (Installation and ConfigurationPlanning):** This section contains a discussion of possible configurations and some considerations for planning the configuration.
- **Section 4 (Installation):** This section contains the information needed to set up and physically install the controller, including switch settings and cabling.
- **Section 5 (NOVRAM Setup and Subsystem Testing):** This section describes the firmware-resident diagnostics and contains instructions for loading drive configuration parameters into the NOVRAM.
- **Section 6 (Troubleshooting):** This section describes fault isolation procedures that can be used to pinpoint trouble spots.
- **Section 7 (MSCP/TMSCP Compatibility and ODT Programming):** This section describes the UC07/08's registers and presents an overview of the Mass Storage Control Protocol (MSCP).
- **Section 8 (Functional Description):** This section describes the controller architecture.
- **Section 9 (Interfaces):** This section describes the controller, LSI-11 bus, and SCSI interfaces.
- **Section 10 (SCSI Protocol Description):** This section describes the protocol used on the SCSI bus.
- **Appendix A (Autoconfigure, CSR and Vector Addresses):** This appendix describes the DEC algorithm for the assignment of CSR addresses and vector addresses.
- **Appendix B (PROM Removal and Replacement):** This appendix contains instructions to remove and replace the firmware so that the user can upgrade the UC07/08 Host Adapter in the field.

- **Appendix C (Drive Parameters):** This appendix provides NOVRAM parameter-setting information for various optical and magnetic disk drives and subsystems.
- **Appendix D (Termination Power):** This appendix describes the different methods for providing termination power.

1.2 Subsystem Overview

The UC07 Host Adapter connects high-capacity SCSI- compatible magnetic disk, optical disk, or magnetic tape subsystems to the Q-Bus in computers manufactured by Digital Equipment Corporation (DEC). Via switch selection, the UC07 implements either DEC's Mass Storage Control Protocol (MSCP) for disk subsystems or Tape Mass Storage Control Protocol (TMSCP) for tape subsystems to provide a software-transparent interface for the host DEC computer. The Small Computer System Interface (SCSI) peripheral interface provides traditional Emulex flexibility in peripheral selection.

The UC08 Host Adapter combines the capabilities of two UC07s on a single printed circuit board assembly. This allows the user to separate slow and fast SCSI peripherals, attaching slower tape devices or optical drives to one SCSI bus, while high-speed magnetic drives use the other SCSI bus.

1.2.1 Mass Storage Control Protocol (MSCP)

MSCP is a software interface designed to lower the host computer's mass storage overhead by offloading much of the work associated with file management into an intelligent mass storage subsystem. In concert with SCSI-compatible peripherals, the UC07 provides just such a subsystem. The UC07 relieves the host CPU of many file maintenance tasks. The UC07 Host Adapter performs these MSCP functions: error checking and correction, bad block replacement, seek optimization, command prioritizing and ordering, and data mapping.

1.2.2 Small Computer System Interface (SCSI)

The Small Computer System Interface, which is used as the UC07 Host Adapter's peripheral interface, complements the MSCP protocol well. SCSI architecture is designed to allow up to eight host adapters and intelligent peripheral controllers to be connected together on an eight-bit data bus (the SCSI bus; see Figure 1-1). Host adapters, such as the UC07, connect computers to the SCSI bus. Intelligent peripheral controllers support mass-storage peripherals such as mini-Winchester disk drives or 8mm tape drives. The devices communicate over the SCSI bus using a device independent protocol that largely masks the data structure of the peripheral. Thus, SCSI architecture allows the host computer to become device independent within certain classes of devices.

SCSI also provides for a large volume of data storage that can be configured in many ways. The bus is fast enough to support modern Winchester-technology disks, and the interface allows seeks and other types of positioning and data commands to be overlapped if there is more than one peripheral controller on the bus.

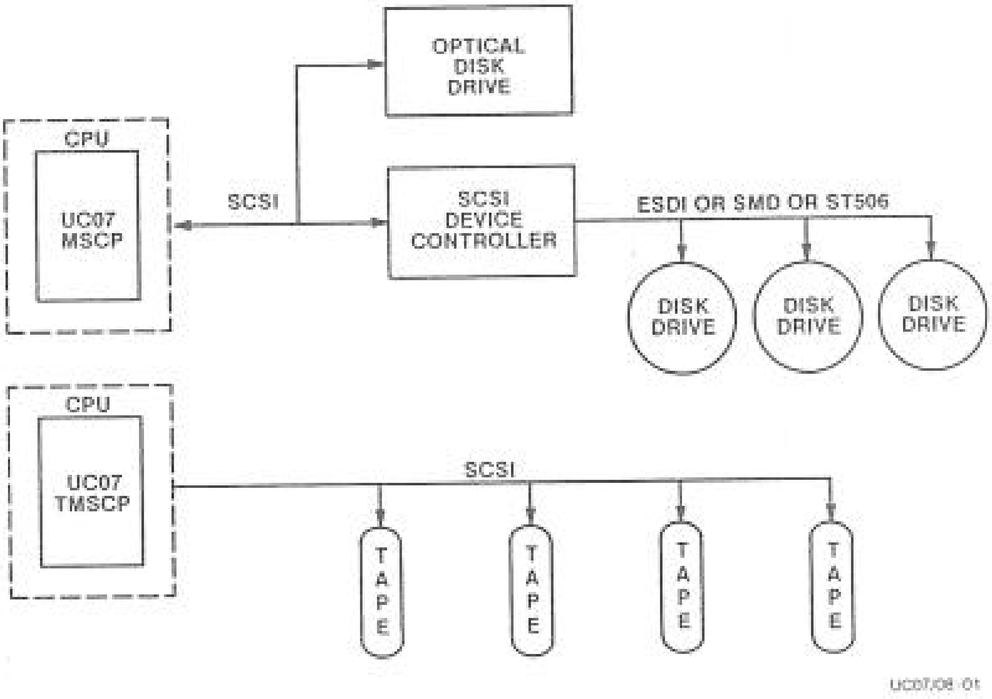


Figure 1–2. Typical UC07 Subsystem Configuration

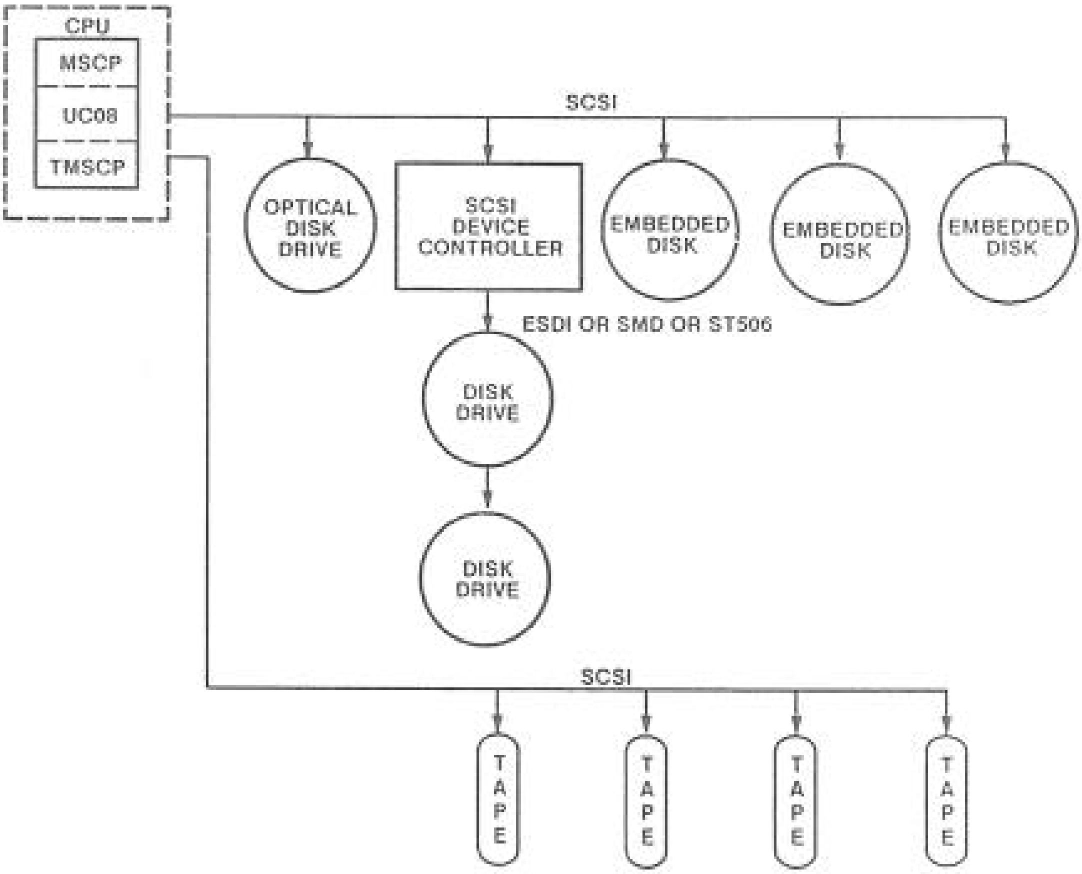


Figure 1–3. Typical UC08 Subsystem Configurations

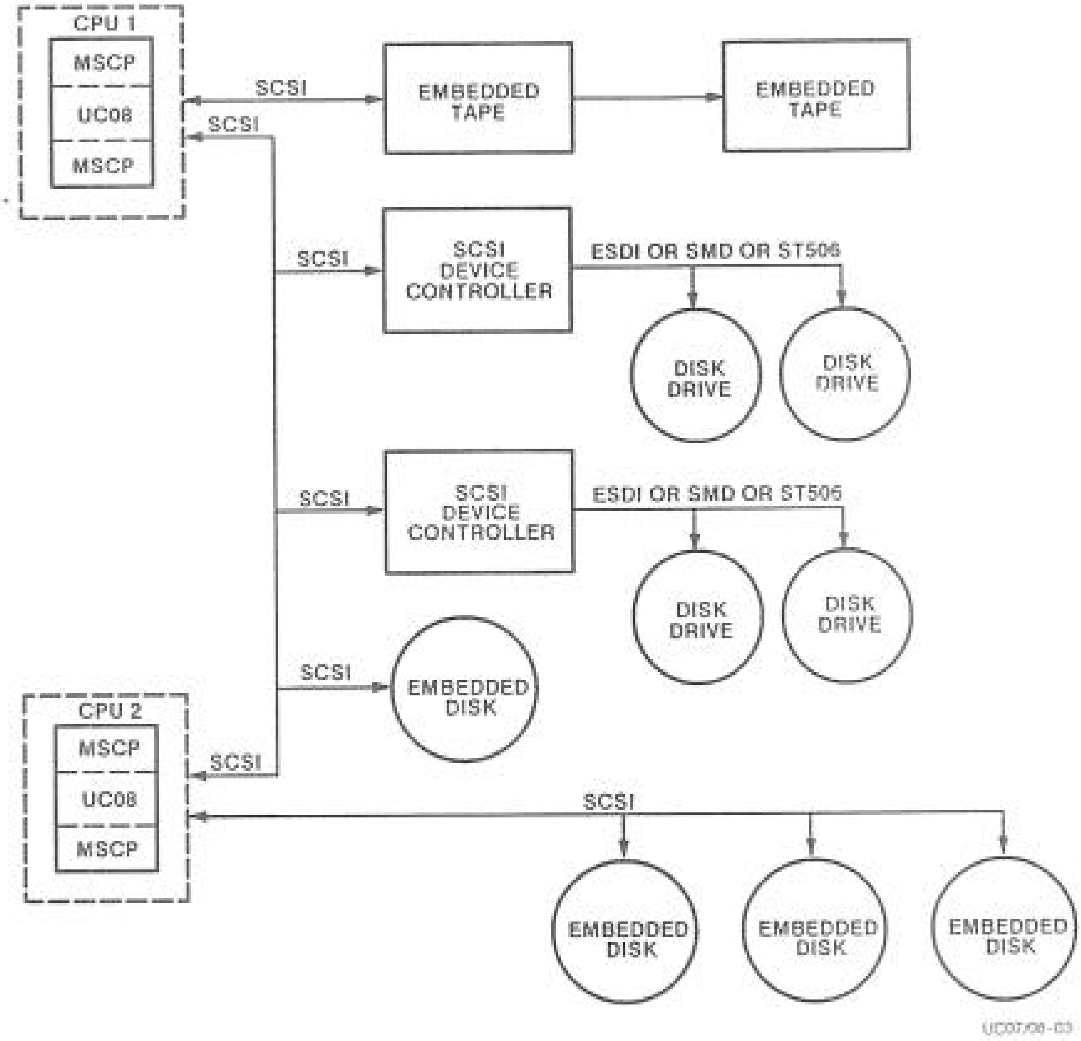


Figure 1–4. Dual CPU UC08 Subsystem Configuration

1.4 Host Adapter Models and Options

The intelligent host adapter, with appropriate peripherals, provides a DEC MSCP-compatible or TMSCP-compatible mass storage subsystem. The host adapter is available in four basic models: the UC07, the UC08, the UC07-III, and the UC08-III. The UC07 and UC07-III each have a single SCSI port; the UC08 and UC08-III are dual versions, each board having two SCSI ports. The UC07-III and the UC08-III are designed for use with the MicroVAX III, while the UC07 and UC08 are for use with the LSI-11. Figure 1-5 shows a photograph of a UC08-III board and a UC08 board.

The current version of the UC07 is contained on a quad-wide printed wiring board. EMULEX is in the process of phasing out this quad-wide version in favor of a dual-wide board. With the exception of a change in form factor, jumper locations, and the selection of termination power, switch definitions are identical to the current quad-wide version. Only the physical location of the components has changed. Component locations on the dual-wide version are shown in Figure 1-7. Jumper configuration for the dual-wide version are shown in Table 4.7. The new board is completely backward compatible with older firmware and hardware revisions of the UC07. See Appendix D for details about termination power jumpering on the dual-wide UC07.

Each intelligent host adapter board is identified by a top level assembly tag that is glued to the 8031 microprocessor chip on the printed circuit board assembly. Tables 1-1 through 1-4 give the top level assembly number of each of the four models of host adapters, along with the part numbers for items that are delivered with them.

Table 1-1. UC07 Basic Contents

Item	Qty	Description	Part Number
1	1	Host Adapter, Quad-wide	UC0710201-02
2	1	Manual	UC0751001-00
3	1	Host Adapter, Dual-wide	UC0710205-02

Table 1–2. UC08 Basic Contents

Item	Qty	Description	Part Number
1	1	Host Adapter	UC0810201–02
2	1	Manual	UC0751001–00

Table 1–3. UC07–III Basic Contents

Item	Qty	Description	Part Number
1	1	Host Adapter	UC0710201–04
2	1	Manual	UC0751001–00
3	1	Distribution Panel	UC0710203–00
4	2	Gap Filler Panel	QT1420102–00

Table 1–4. UC08–III Basic Contents

Item	Qty	Description	Part Number
1	1	Host Adapter	UC0810201–04
2	1	Manual	UC0751001–00
3	1	Distribution Panel	UC0710203–00
4	2	Gap Filler Panel	QT1420102–00

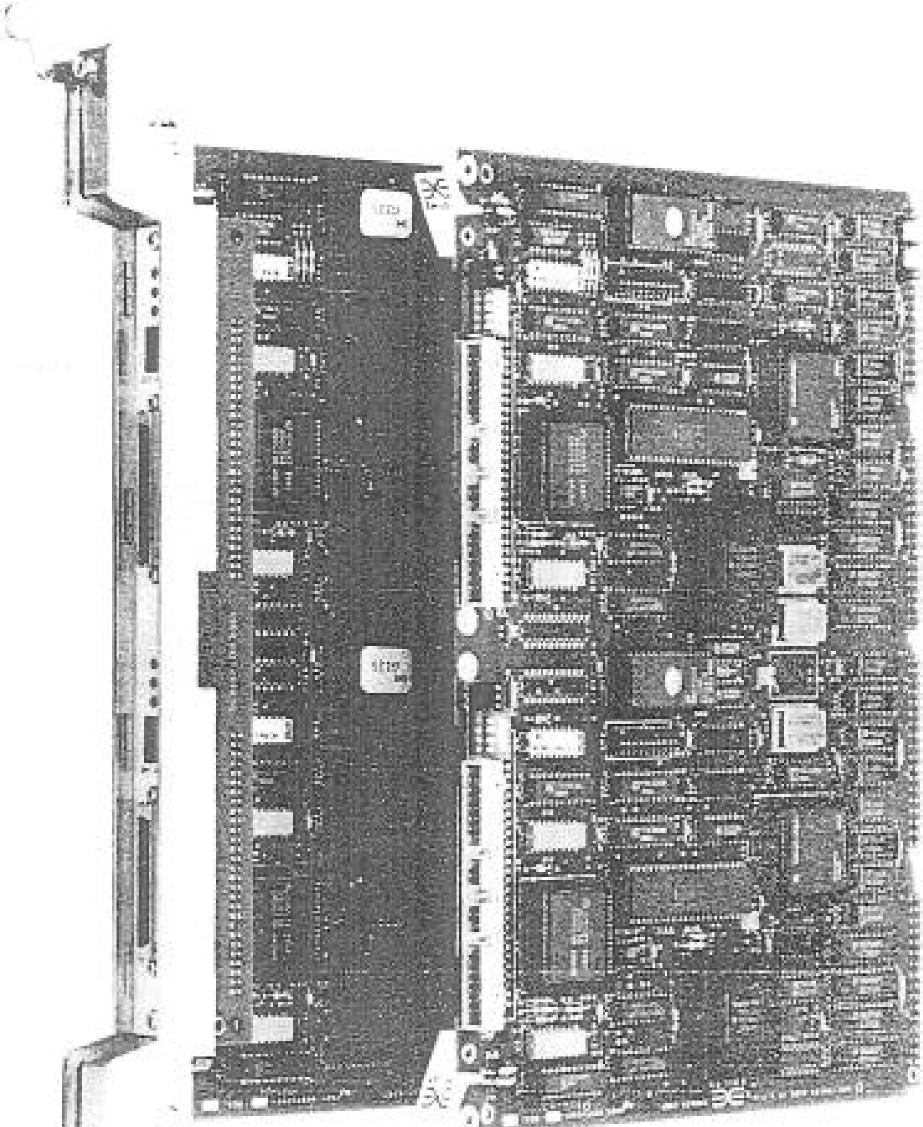
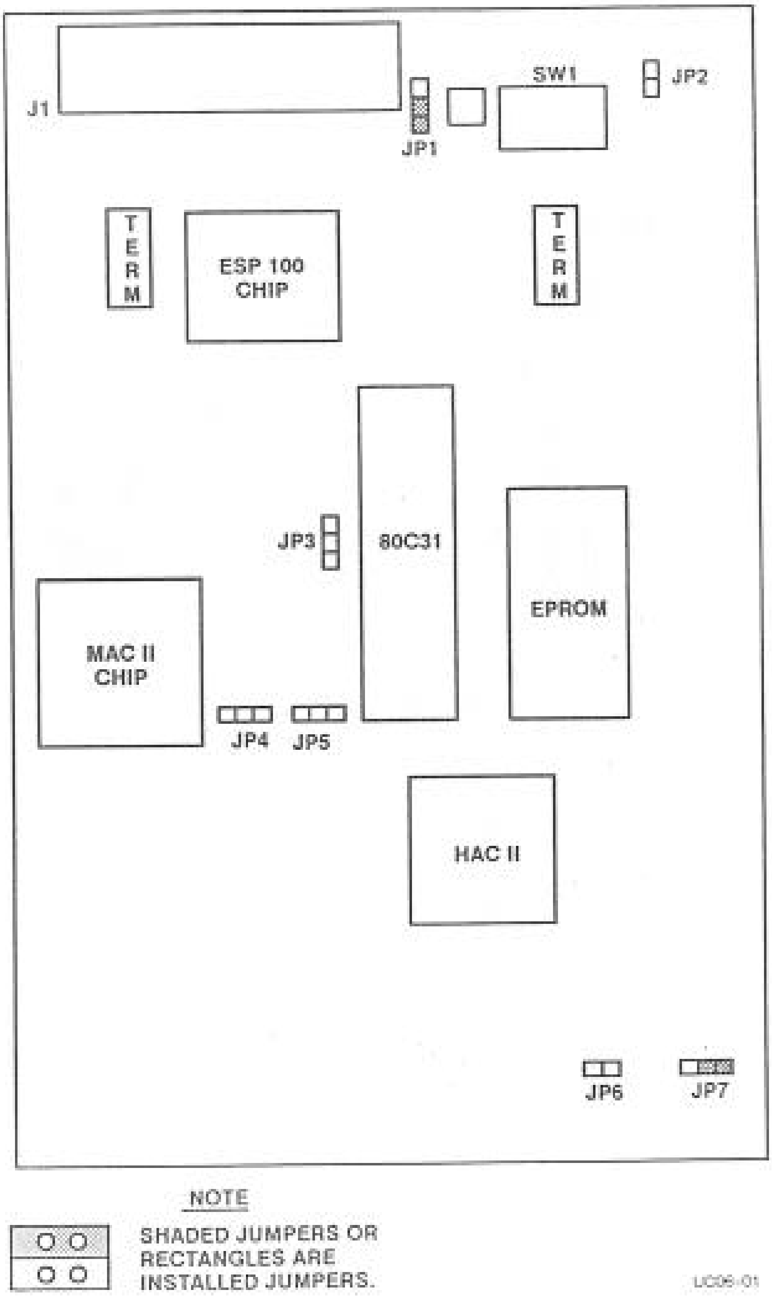


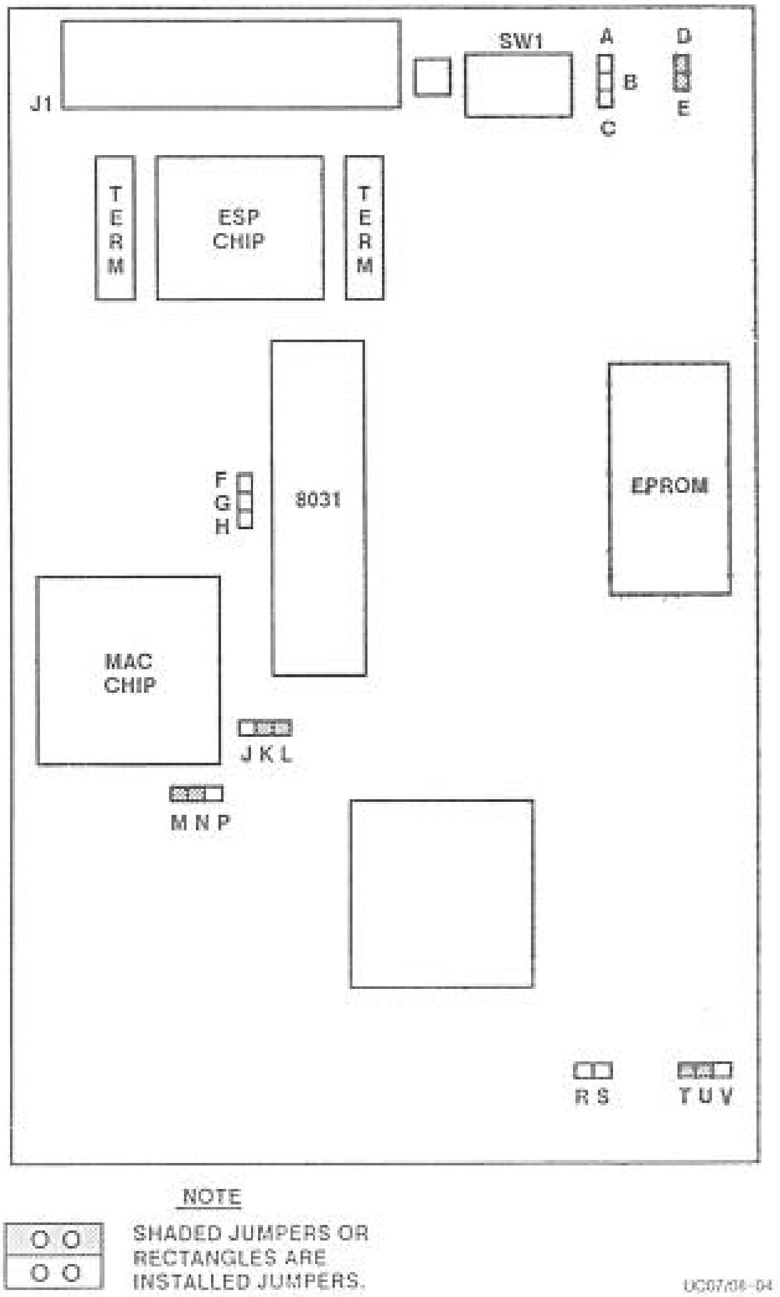
Figure 1-5. UC08-III and UC08 Host Adapters



NOTE

SHADED JUMPERS OR RECTANGLES ARE INSTALLED JUMPERS.

Figure 1–6. UC06 Dual-wide Component Locations



NOTE

SHADED JUMPERS OR RECTANGLES ARE INSTALLED JUMPERS.

Figure 1–7. UC07 Dual-wide Component Locations

1.4.1 Subsystem Options

Table 1-5 lists the options that can be ordered to tailor your UC07 or UC08 to your particular application. Options are specified as separate line items on a sales order.

Table 1-5. UC07 and UC08 Options

Option	Description
PU0213001	MICRO/PDP/VAX Cable Kit for MICRO/PDP-11 or MicroVAX chassis patch panels. Converts UC07 J1, UC08 J1, or UC08 J2 to AMP connector. Includes SCSI cable, adapter, and hardware. Fully compatible with all Emulex SCSI subsystems.
PU0120105	MICRO/PDP/VAX Patch Panel. Required for installation of Emulex CP24 Distribution Panel and UC07/08 Controllers. Ordered in addition to PU0213001, above.
PU0113003	Rack mount cable kit for universal RETMA rack mount applications. Converts UC07 J1, UC08 J1, or UC08 J2 to AMP connector. Includes SCSI cable, rack mount, adapter, and hardware. Fully compatible with all Emulex SCSI subsystems.
PU0113004	LSI-11/23 Chassis Mount Kit for LSI-11/23 BC type chassis. Mounts AMP connector in LSI-11/23 BC chassis. Includes SCSI cable, adapter, and hardware. Fully compatible with all Emulex SCSI subsystems.
CKUC07-15	High-density Cable Kit. Contains one 15-foot, 50-pin, high-density shielded cable necessary for UC07-III and UC08-III. Connects host adapter located in CPU chassis to distribution panel located in adjacent peripheral cabinet. Two kits necessary for UC08-III.

1.5 Features

The following features enhance the usefulness of the UC07/08 Host Adapter.

1.5.1 Microprocessor Design

The UC07/08 design incorporates an eight-bit, high performance CMOS microprocessor to perform all controller functions. The microprocessor approach provides a reduced component count, high reliability, easy maintainability, and the microprogramming flexibility that allows MSCP to be implemented without expensive, dedicated hardware.

1.5.2 Improved Throughput

By using our custom designed buffer controller chip and host adapter controller chip, the UC07/08 can perform DMA transfers on the host LSI-11 bus in excess of 2M bytes per second with a peak rate of 950 nanoseconds per word.

1.5.3 Firmware-resident Diagnostics

The UC07/08 host adapter firmware incorporates a self-contained set of media preparation and diagnostic utilities.

These utilities allow the user to communicate directly with the UC07/08 via a firmware-resident terminal driver that is compatible with either CRT or hardcopy devices connected to an LSI-11 or MicroVAX console port. These firmware-resident diagnostics (F.R.D.) provide several important configuration and media preparation functions, including the ability to:

- Configure the host adapter NOVRAM
- Format magnetic disk drives
- Test the media surface of disk drives and replace defective blocks
- Perform reliability testing of the attached disk or tape subsystem
- Initialize the RCT area on optical media
- Provide read/write test capability on a special diagnostic area of the optical media

1.5.4 Custom Configuration Capability

An onboard NOVRAM can be programmed to support as many as seven SCSI–compatible controllers with peripherals of varying storage capacities. The user can specify many different drive configurations. Using the firmware-resident utilities, you can control drive parameters such as the number of disk sectors per track.

1.5.5 Self–test

The UC07/08 incorporates an internal self–test routine which exercises all parts of the microprocessor, the onboard memory, the buffer controller, the Host Adapter Controller (HAC), and the ESP chip. Although this test does not completely test all circuitry, successful execution indicates a very high probability that the host adapter is operational. If the UC07/08 fails the self–test, it leaves three light–emitting diodes (LEDs) ON and sets an error bit in the Status and Address (SA) register (base address plus two).

1.5.6 Error Control and Block Replacement

The UC07/08 offers a choice of three different methods of error control which are user–selectable via NOVRAM. Each of these modes has unique advantages depending on the application.

1.5.7 Manual Bad Block Replacement

For magnetic disk devices, the firmware–resident diagnostics allow the user to manually enter bad blocks that are not replaceable with normal methods.

1.5.8 Command Queuing

The UC07/08 has a buffer which can store up to fifteen MSCP commands. The UC07/08 has the ability to sort these stored commands to provide optimal access to the attached disk drives. The ability to store and sort commands makes the UC07/08 particularly efficient in heavily loaded multi–user systems.

1.5.9 Disconnect/Reconnect

The UC07/08 fully supports standard SCSI arbitration, including disconnect/reconnect. Using this feature, drives that are performing time-consuming tasks (e.g., seeks) release the SCSI bus temporarily and reconnect when the seek is complete. Support of this feature permits the UC07/08 to initiate commands simultaneously on multiple controllers; thus, several operations can be performed at once. The disconnect/reconnect option ensures efficient use of the SCSI bus and provides maximum overall subsystem throughput.

1.5.10 Adaptive DMA

During each DMA data transfer burst, the UC07/08 monitors the LSI-11 bus for other pending DMA requests and suspends its own DMA activity to permit other DMA transfers to occur. The host processor programs the DMA burst length during the MSCP or TMSCP initialization sequence, or the UC07/08 defaults to 16 words per burst. In addition, the UC07/08 allows the user to select the delay between data bursts via NOVRAM. Because of these adaptive DMA techniques, the UC07/08 ensures that CPU functions, including interrupt servicing, are not locked out for excessive periods of time by high-speed disk or tape transfers.

1.5.11 Block-mode DMA

The UC07/08 supports block-mode DMA for accessing memory. In this mode, the initial address of the data is transmitted, followed by a burst of up to 16 words of data. The memory address is automatically incremented to accommodate this burst. Block mode transfers considerably reduce the overhead associated with DMA operations.

1.5.12 22-bit Addressing

The UC07/08 supports the 22-bit addressing capability of the extended LSI-11 bus.

1.5.13 Multi-CPU Support

The UC07/08 offers two kinds of multi-CPU support: MSCP emulation and TMSCP emulation.

1.5.13.1 MSCP Emulation

The use of dynamic multi-initiator configurations in multiple CPUs has been added. This feature is required in multi-CPU configurations where asynchronous and unsolicited SCSI resets from one CPU must not be allowed to interfere with ongoing operations performed by other CPUs on the same SCSI bus. If this feature is used, all devices on the SCSI bus must support disconnects. Note that the current SCSI specification does not clearly define conditions that can occur if some SCSI devices on the same SCSI bus are powered OFF. Therefore, Emulex requires that all devices sharing a common SCSI bus be powered ON for proper operation.

Write Once Read Many (WORM) optical drives are not supported in this configuration unless used for read only purposes. Ensure that proper SCSI termination is observed, as well as maximum SCSI cable length. (See Table 2-1 for cable length details.)

1.5.13.2 TMSCP Emulations

The UC07/08 supports the use of multi-CPU configurations with the TMSCP emulation. However, because some SCSI tape devices could go into self-test modes which will run for up to 1.5 minutes, dynamic sharing of tape devices is not allowed. Emulex recommends each tape device be logically mounted to only one CPU at a time.

1.5.14 Fast File Search (Tape Emulation Only)

UC08 firmware revision "G" and above supports the use of high-speed file search operations available on EXABYTE tape drives. Certain limitations in the way high-speed searches operate on the EXABYTE drive might not be compatible with all operations performed by various DEC operating systems; therefore, this feature can be disabled via a switch located on the UC07/08. Refer to Table 4-1 for switch settings.

1.5.15 User Selectable SCSI Autoconfigure

This feature allows the user to ask the UC07/08 to load its NOVRAM device information by using the INQUIRY, MODE SELECT, MODE SENSE, or READ CAPACITY commands to locate and identify all disk devices present on the SCSI bus. The autoconfigure process also loads each device's physical geometry information into the NOVRAM for use as default values, unless modified by the user.

This feature autoconfigures all available SCSI devices and all attached logical units until a maximum of eight drives are found. Once a device is identified, it is listed on the console with the vendor identification, the product identification, and the revision level (if the device is CSS compatible). Once completed, the default values are displayed if you wish to edit any entry. Only disk devices allow for autoconfigure.

1.5.16 Multiple Tape Drive Support

The UC07/08 supports up to seven SCSI tape devices by appearing to the system as multiple drives attached to a single TMSCP tape coupler. Each device can be accessed individually.

Multi-drive configurations are very useful in applications that require automated unattended backups. With seven 8mm drivers attached to a single UC07 port, over 14 gigabytes of unattended backup capability are provided. In addition to the above convenience, the UC07 supports any mix of SCSI tape devices, including:

- 4mm DAT
- 8mm Helical Scan
- 1/2" cartridge
- 1/2" reel-to-reel
- Full 3480 compatibility

1.6 Compatibility

In designing the UC07/08, Emulex has made every effort to maintain compatibility with the SCSI Interface. However, because of the flexibility of the SCSI Interface Specification itself, and the large number of vendors producing "SCSI-compatible" disk and tape controllers, it is virtually impossible to guarantee that any particular SCSI disk or tape controller will function correctly when attached to the UC07/08. In addition, some of the restrictions imposed by the requirements of MSCP compatibility might prevent some devices which rely heavily on "vendor unique" command modifiers from being supported. The following section will summarize the various compatibility issues mentioned in the manual and also will list a number of vendor-specific devices which have been tested and found to work with the UC07/08.

1.6.1 Protocol Compatibility

The UC07/08 is compatible with the SCSI Interface Specification as defined by ANSI X3T9.2/82-2 Rev 17B for Direct Access, WORM, and Sequential Access devices. In addition, the industry standard, Common Command Set, is fully supported. The following documents were used for reference during the development of the SCSI interface on the UC07/08:

- ANSI specification X3T9.2/82-2 Rev 17B
- CDC SCSI Interface Specification 64721700 Rev B
- Emulex SCSI Disk Controller Programming Reference Manual (P/N MD2352501)
- Exabyte Corp. Interface Users Manual MKT-016-00
- Optimem Optical Disk Drive Interface Manual (P/N G09-083890-001)
- Maxtor Corp. XT-8000S Product Specification and OEM Manual (1015586 Rev A)

1.6.1.1 MSCP Compatibility

In the MSCP mode, when using magnetic disk drives, the UC07/08 is compatible with the standard DEC DU device driver used in all DEC operating systems. In the MSCP mode, when using optical disk drives, the UC07/08 is compatible with either the Emulex OD/OT Driver for VMS-based systems, or the optical software produced by Perceptics Corp.

In order to support the full host-initiated block replacement scheme provided by MSCP, the SCSI magnetic disk driver controller must support both the SCSI READ LONG and SCSI WRITE LONG commands as defined by the industry standard Common Command Set (CCS). All Emulex SCSI disk controllers support this requirement. When using non-Emulex device controllers, refer to the technical documentation supplied with the device.

1.6.1.2 TMSCP Compatibility

In TMSCP mode, the UC07/08 is fully compatible with the standard DEC TMSCP device driver for TU81 operation. Each SCSI port designated for TMSCP appears as one controller with up to seven tape devices attached. Remote density is supported on drives that retain this feature.

1.6.2 Device Compatibility

The following is a list of the SCSI devices that have been tested or reviewed and found to be compatible with the UC07/08. If your device does not appear on this list, it does not mean that it will not work.

With peripheral manufactures adding new products constantly, Emulex has developed a policy that enables customers to use disk and tape devices that have not yet been qualified. We suggest you follow the basic rules for connecting your SCSI device and use the Emulex automatic setup for disks, as well as examples in this manual for loading tapes to NOVRAM. Once this is accomplished, all the applicable diagnostics should be invoked. If diagnostics completes without errors, then the supported operating system should perform the final testing.

If you discover a problem during your testing of a particular peripheral, contact Emulex Technical Support for telephone assistance. If the problem cannot be resolved, Emulex will be happy to investigate the problem if you can provide a peripheral for evaluation. Please discuss the options with Technical or Sales Support should you encounter any peripheral compatibility issue.

CAUTION! With the exception of products manufactured by Emulex, no warranties, either expressed or implied, are made as to the reliability or performance of any devices listed in this document. In addition, Emulex is not responsible for the applicability of any of the devices listed to a particular system configuration or for their intended use.

Magnetic Disk Controllers:

- Emulex MD01
- Emulex MD21
- Emulex MD23
- Emulex MD25

Magnetic Disk Drives with Embedded SCSI Controllers:

- Connors Peripherals
- DEC RZ Series Drives
- Fujitsu SCSI Series
- Hewlett-Packard 97548S

- Hitachi SCSI
- Maxtor 4000S Series
- Maxtor 8000S Series
- Micropolis 137XS Series
- NEC SCSI
- Priam 738
- Seagate SCSI
- Toshiba SCSI

Optical Disk Drives: (WORM)

- LMSI LD1200 12-inch
- LMSI LD5105 5.25-inch
- Optimem 1000
- Optimem 2400
- Laserdrive Ltd. Model 840
- Maxoptix
- Magneto-Optical Drive
- Sony Magneto-Optical Drive
- Richo Magneto-Optical Drive

Compact Disk Drives: (CD)

- DEC RRD Series Drives
- Sony CD4-541-01

Magnetic Tape Drives:

- ARCHIVE 4mm DAT
- Cipher M995S
- Exabyte Corp. 8400 8mm Tape Drive
- Fuji 3480
- Gigatrend 4mm DAT Drive
- LMSI 3480
- Sony 4mm DAT Drive
- Wangdat 4mm DAT

1.6.3 CPU Compatibility

The UC07/UC08 is compatible with the Q-Bus used on all DEC LSI-11 and all DEC MicroVAX II, 3XXX, and 4XXX series computers.

The UC07/UC08 is not supported on DEC MicroVAX I computers due to the lack of "Scatter Gather" support.

1.6.4 Known Limitations

1.6.4.1 EXABYT Limitations

ULTRIX 11 and ULTRIX 32M share the same EXABYTE limitation: When either system is used with EXABYTE in TMSCP mode, the "r" key cannot be used with TAR (Tape Archive) to append files. This operation requires the drive to position between blocks and overwrite. The drive is not capable of this operation.

1.6.4.2 Operating Systems Limitations

The following operating systems support only one tape drive per TMSCP port:

- RSX11M
- RSX11M PLUS
- RSTS/E
- RT11

Your software might create a second limitation: Automated switching of tape drives at EOT as used in unattended backup is the responsibility of the operating system software. VMS supports the definition of multiple tape units as part of its backup utility; however, your software must support this feature. Consult your VMS backup utility documentation for details regarding available features and configuration.

Other operating systems might require special software or command files written by the user. Consult the appropriate documentation.

1.6.4.3 Firmware Limitations

The current version of UC07/08 firmware does not support the SCSI Reserve and Release functions. It, therefore, cannot function as a dual-ported disk in applications that require the disk to be on-line to only one CPU at a time (LAVC Systems) because proper Lock Management Functions are not provided.

1.6.4.4 Multi–CPU Limitations

In the case where multi–CPUs share a common set of multiple tape drives, Emulex recommends that each tape device be logically mounted by only one CPU at a time. It is possible for each CPU to simultaneously mount and access different tape drives on the same SCSI bus.

Emulex does not recommend the use of STABACKIT to build bootable tapes on 8mm Helical Scan Drives. Standalone Back-up tapes can be successfully built and booted on 4mm DAT, 1/2 inch reel-to-reel or cartridge drives, or 3480 drives.

1.6.5 Multi-initiator

This configuration can be used in applications that require multiple CPU access to a shared set of peripherals among two or more CPUs. By programming the NOVRAM on each host adapter, the user can determine which of the attached drives can be accessed by any CPU. This configuration requires special care to prevent dynamic multi-access unless special software is used to perform Lock Management Functions.

Also, because the Intelligent Host Adapter passes QBUS resets directly through to the SCSI bus in the form of SCSI bus resets, some form of protection must be defined to prevent the host adapter on any one CPU from issuing SCSI resets while the SCSI bus is being accessed by another host adapter. This condition is eliminated when the UC07/08 firmware is used for MSCP emulation. In TMSCP mode, when used with firmware Rev M and above, SCSI resets can be disabled by setting SW1–3 to ON (see subsection 4.3.7).

Section 2
CONTROLLER SPECIFICATIONS

2.1 Overview

This section contains the general, environmental, physical, and electrical specifications for the UC07/08 Host Adapter.

Subsection	Title
2.1	Overview
2.2	General Specifications
2.3	Environmental Specifications
2.4	Physical Specifications
2.5	Electrical Specifications

2.2 General Specifications

Table 2–1 contains general specifications for the UC07/08 Host Adapter.

Table 2–1. UC07/08 General Specifications

Parameter	Description
FUNCTION	Providing mass data storage to Digital Equipment Corporation (DEC) computers that use the LSI–11 Bus
Logical CPU Interface	Switch–selectable emulation of DEC's Mass Storage Control Protocol (MSCP) or Tape Mass Storage Control Protocol (TMSCP)
Diagnostics	Embedded diagnostics
Operating System Compatibility (MSCP)	Micro/VMS V4.0 and above RSTS/E V8.0 and above RSX–11M V4.1 and above RSX–11M PLUS V2.1 and above RT–11 V5.1 and above Ultrix–11 V3.0 and above Ultrix–32m V1.1 and above
Operating System Compatibility (TMSCP)	Micro/VMS V4.0 and above RSTS/E V9.6 and above RSX–11M PLUS V3.0 and above RT–11 V5.4 and above Ultrix–11 V3.0 and above Ultrix–32m V2.2 and above
CPU I/O Technique	Direct Memory Access (DMA), including adaptive techniques and block mode
INTERFACE	
CPU Interface	Q–Bus interface
Device Base Address (MSCP)	Standard 17772150_8 Alternates 17772154_8 17760334_8 17760340_8 17760344_8 17760350_8 17760354_8 17760360_8 17760364_8 17760370_8 17760374_8 17760400_8 17760404_8 17760410_8 17760414_8 17760420_8

(Continued on next page)

Table 2–1. UC07/08 General Specifications(Continued)

Parameter	Description
Device Base Address (TMSCP)	Standard 17774500_8 Alternates 17760404_8 17760410_8 17760414_8 17760444_8 17760450_8 17760454_8 17760504_8 17760510_8 17760514_8 17760520_8 17760524_8 17760530_8 17760534_8 17760540_8 17760544_8
Vector Address	Programmable
Priority Level	BR4 or BR5 (jumper-selectable)
Peripheral Interface	Small Computer System Interface (SCSI)
Driver Option	Single ended
Maximum Length	20 ft. (6 m.)
SCSI Commands used with MSCP Implementation	00H Test Unit Ready 03H Request Sense 04H Format Unit (extended)* 07H Reassign Block 08H Read 0AH Write 12H Inquiry 15H Mode Select 1AH Mode Sense 1BH Start/Stop Unit 25H Read Capacity 28H Read (extended) 2AH Write (extended) E8H Read Long** EAH Write Long**
Firmware Diagnostic Access Path	
LSI-11	Standard console terminal
MicroVAX	Standard console terminal or GPX workstation monitor

*Formatting only

**Vendor-unique commands on Emulex disk drive controllers

2.3 Environmental Specifications

Table 2-2 contains the environmental specifications for the UC07/08 Host Adapter.

Table 2-2. UC07/08 Environmental Specifications

Parameter	Description
OPERATING TEMPERATURE	10°C (50°F) to 40°C (104°F), where maximum temperature is reduced 1.8°C per 1000 meters (1°F per 1000 feet) altitude
RELATIVE HUMIDITY	10% to 90% with a maximum wet bulb of 28°C (82°F) and a minimum dewpoint of 2°C (3.6°F)
COOLING	6 cubic feet per minute
HEAT DISSIPATION	UC07: 40 BTU per hour UC08: 80 BTU per hour

2.4 Physical Specifications

Table 2-3 contains the physical specifications for the UC07/08 Host Adapter.

Table 2-3. UC07/08 Physical Specifications

Parameter	Description
PACKAGING	Single, quad-wide, four-layer PCBA
Dimensions	10.436 by 8.70 inches 26.507 by 22.098 centimeters
Shipping Weight	3 pounds

2.5 Electrical Specifications

Table 2–4 lists and describes the electrical specifications for the UC07/08 Host Adapter.

Table 2–4. UC07/08 Electrical Specifications

Parameter	Description
POWER	UC07: +5 VDC ± 5%, 2.3 A max.* UC08: +5 VDC ± 5%, 4.5 A max.*
BUS LOADING	AC bus loads: 2.5 max. DC bus loads: 1 max.
SCSI BUS TERMINATION POWER	Jumper-selectable, 4.75 VDC to 5.25 VDC, diode-isolated and fused at 1 A
*Maximum current rating might be slightly higher if board is jumpered to supply terminator power.	

Section 3
INSTALLATION AND CONFIGURATION PLANNING

3.1 Overview

This section is designed to help you determine the best possible subsystem configuration for your application. It will outline the performance capabilities, design constraints, and other factors which must be taken into account when configuring your subsystem. It is not intended to help you generate, adjust, or configure your operating system to use a UC07– or UC08–based subsystem. For information on these subjects you should consult your operating system documentation.

The UC07 and UC08 are high-speed, Intelligent Host Adapters that allow you to interface a wide variety of SCSI devices to the DEC Q-Bus. The use of the SCSI bus as the peripheral bus provides a high degree of configuration flexibility not normally available with device controllers using dedicated peripheral buses. The following subsections show some of the possible configurations and outline the performance issues and restrictions that apply to each:

Subsection	Title
3.1	Overview
3.2	UC07 and UC08 Versions
3.3	UC07 and UC08 Configurations
3.4	Performance Considerations

3.2 UC07 and UC08 Versions

The Intelligent Host Adapter is available in two basic versions, the UC07 and the UC08.

3.2.1 UC07

The UC07 is the most basic version of the Intelligent Host Adapter. It consists of a single UNIBUS to SCSI bus Host Adapter on one quad-wide circuit board. The UC07 appears to the operating system as a single MSCP or TMSCP emulation (depending on board setup) that resides at one of 16 switch selectable base addresses assigned to MSCP or TMSCP emulations. The UC07 performs either an MSCP or a TMSCP emulation, as determined by an onboard switch setting. If desired, the SCSI bus of two or more UC07 Host Adapters can be connected to the same SCSI cable to form a single SCSI bus with shared peripherals. However, this type of connection is only usable if all Host Adapters are set to perform the same type of emulation (MSCP or TMSCP). In either mode, each SCSI Port can support a maximum of seven (7) SCSI target devices. Each MSCP SCSI target can support up to eight (8) LUNs; however, the maximum number of LUNs that can be attached to an MSCP SCSI Port is eight (8).

3.2.2 UC08

The UC08 consists of two completely independent Intelligent Host Adapters, each with its own UNIBUS and SCSI bus interface, on one quad-wide circuit board. The UC08 appears to the operating system as two independent MSCP or TMSCP emulations, each of which reside at one of 16 switch selectable base addresses assigned to MSCP and TMSCP emulations. Each of the host adapters is individually switch selectable for either MSCP or TMSCP emulation. Thus, one UC08 can appear to the operating system as either one MSCP and one TMSCP, two MSCP or two TMSCP emulations. If desired, the two SCSI buses on one UC08 Host Adapter can be connected to the same SCSI cable to form a single SCSI bus with shared peripherals. However, this type of connection is only usable if both UC08 sections that share the SCSI bus are set to perform the same type of emulation (MSCP or TMSCP). In either mode, each SCSI port can support a maximum of seven (7) SCSI target devices. Each MSCP SCSI target can support up to eight (8) LUNs; however, the maximum number of LUNs that can be attached to an MSCP SCSI port is eight (8).

3.3 UC07 and UC08 Configurations

NOTE: A SCSI device can be either an initiator or a target. An initiator is a SCSI device that requests an operation to be performed by another SCSI device. A target is a SCSI device that performs an operation requested by an initiator. On the SCSI bus, the UC07/08 always acts as an initiator.

The possible configurations for the Intelligent Host Adapter are as follows:

1. **Single initiator, single target, single host adapter.**

   This is the most basic use of the UC07 or UC08. The UC07 can function as either an MSCP or TMSCP controller. When performing an MSCP emulation, the attached target device can be either a magnetic or optical disk device.

2. **Single initiator, multi-target, single host adapter.**

   In this configuration, the UC07 initiator can be in MSCP or TMSCP mode. Special software might be required when using this configuration with a mixture of optical WORM and magnetic drives on the same MSCP emulation. In general, there are no restrictions to mixing 4mm, 8mm, or other SCSI tape devices on the same SCSI port. Tapes and disks must not be mixed on the SCSI Bus in this configuration because a host adapter would be required to perform MSCP and TMSCP simultaneously.

3. **Single initiator, single target, dual host adapter.**

   This configuration uses either two UC07s or a single UC08. It is most generally used with the UC08 when a single CPU needs both MSCP and TMSCP on a single quad-wide board slot.

   This configuration can also be used to allow mixing of both magnetic and optical disks on the same CPU, while allowing the user to operate the magnetic disk with the standard DEC DU Driver while a separate custom driver is used for the optical disks.

   Another possible use of this configuration is in a single CPU system with multiple drives, where the user wants to split the drives between two host adapters to balance the DMA load and provide better performance than is possible with multiple drives on one host adapter.

4. **Single initiator, multi-target, dual host adapter.**

   This is very similar to Configuration 3 above, except that if each initiator is performing MSCP emulation, then each initiator can support multiple targets on its SCSI bus. If either initiator is performing a TMSCP emulation, that initiator must have only one target device attached to its SCSI Bus.

5. **Multi-initiator, single or multi-target, dual host adapter, multi-CPU.**

   This configuration can be used in applications that require multiple CPU access to a shared set of peripherals among two or more CPUs. By programming the NOVRAM on each host adapter, the user can determine which of the attached drives can be accessed by any CPU. This configuration requires special care to prevent dynamic multi-access unless special software is used to perform Lock Management Functions.

Also, because the Intelligent Host Adapter passes Q-Bus resets directly through to the SCSI Bus in the form of SCSI bus resets, some form of protection must be defined to prevent the Host Adapter on any one CPU from issuing SCSI resets while the SCSI Bus is being accessed by another Host Adapter. This condition has been eliminated with UC07/08 revision "G" and later firmware.

The current version of UC07/08 firmware does not support the SCSI Reserve and Release functions. It, therefore, cannot function as a dual-ported disk in applications that require the disk to be on-line to only one CPU at a time (to provide proper Lock Management Functions). Such applications include LAVC or other non-HSC-based cluster configurations.

It is still possible for each CPU to simultaneously mount and access different tape drives on the same SCSI bus because multi-CPUs share a common set of multiple tape drives; however, Emulex recommends that each tape device be logically mounted by only one CPU at a time.

6. **Other Complex Configurations.**

Figure 3-1 illustrates a very complex multi-CPU, multi-host-adapter configuration, which demonstrates the high degree of system configuration flexibility that the Intelligent Host Adapter provides. This configuration requires special lock management software to control multiuser dynamic access to the shared peripherals.

In this configuration, one of the magnetic disks shared by CPU "A" and CPU "B" is set up as a split logical drive. CPU "A" is set up to use the first half of this drive as the system disk, and to bootstrap from this disk. The second half of the drive is either mounted as Read Only or left unmounted by CPU "A". CPU "B" is set up to use the second half of the split drive as the system disk, and to bootstrap from this disk, with the first half of the disk mounted as Read Only or unmounted.

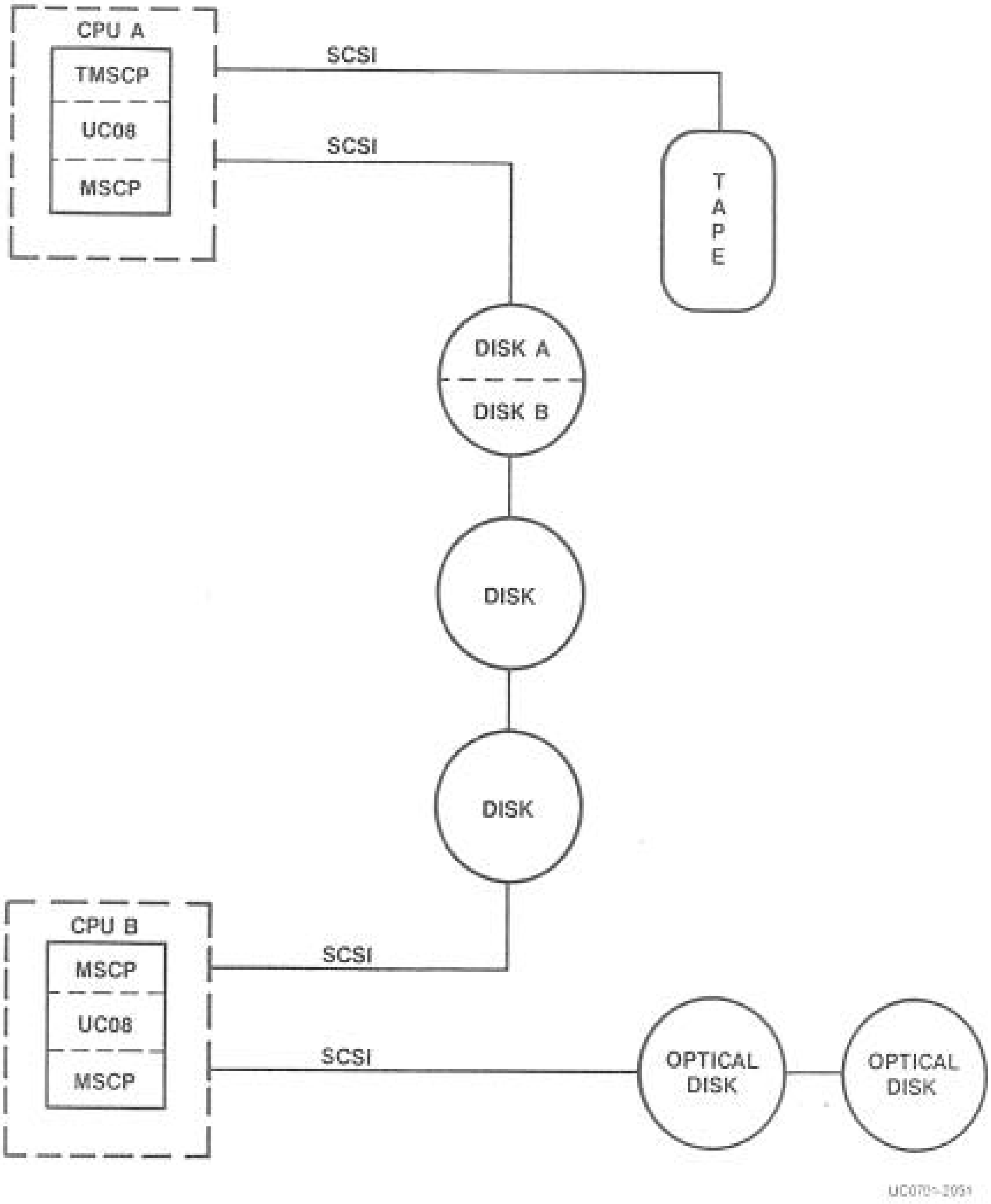


Figure 3-1. Complex UC08 Configuration

3.4 Performance Considerations

3.4.1 Disk Subsystems

The UC07 Host Adapter uses the Emulex ESP chip to provide an extremely high-speed logical connector to the SCSI bus. In addition, the UC07 supports synchronous transfer disk devices that can support transfer rates up to 4.9 M bytes per second.

The main advantage offered by the UC07 is configuration flexibility. In addition, SCSI's ability to interleave DMA operations in multi-drive, multi-tasking applications might provide better performance than a similarly configured ESDI subsystem.

3.4.2 Tape Subsystems

The UC07/08 can be used with a wide variety of SCSI-based tape drives. The main differences between drive types used will show in capacity and performance. The following subsections list the effects of drive type.

3.4.2.1 8mm and 4mm Cartridge Tape Drives

The UC07 can be used with a wide variety of 8mm to 4mm DAT tape drives to emulate a DEC TU81 subsystem. The UC07 and Exabyte combination offers the user a highly reliable, extremely high capacity tape subsystem. However, this combination does perform differently than a SCSI-based 1/2 inch reel-to-reel tape subsystem. In general, the following differences should be expected:

- The transfer rate of the UC07/Exabyte is lower than that available with a 50 IPS or faster GCR tape subsystem. However, backup times in multi-reel backup applications will be similar or lower for the UC07/Exabyte subsystem due to more efficient streaming and lack of operator intervention for tape changing.
- Any operations that utilize large amounts of tape positioning and directional changes will be considerably slower on the UC07/Exabyte tape subsystem. This means that logical operations such as mounting, initializing, etc., will appear to take longer than would similar operations on traditional tape subsystems. The 4mm DAT will offer some improvement over 8mm, but will not be as fast as 1/2" cartridge or reel-to-reel drives.

- Emulex strongly recommends that the 8mm- and 4mm based tape subsystems be used primarily with minimum tape positioning utilities such as VMS Backup, RSX-11M BRU, RSTS Backup, or RT11 BUP. Other utilities such as COPY, PIP, and FLX should be used only as absolutely necessary. While the UC07 is compatible with all these utilities, the combination of positioning commands, file mark generation, etc., associated with these utilities makes the UC07 tape subsystem very slow when compared to traditional tape subsystems.

3.4.2.2 1/2" Cartridge and Reel-to-Reel Drives

The 1/2" cartridge drives, such as the LSMI 3480, Fujitsu 3480 or 1/2" reel-to-reel drives, offer performance comparable to standard 1/2" Pertec Interface tape drives. This means that all normal utilities used with traditional Pertec tape subsystems can be used with no performance penalties.

Section 4
INSTALLATION

4.1 Overview

This section describes the installation of the UC07/08 Host Adapter. Including this overview, this section is divided into six main subsections:

Subsection	Title
11.1	Overview
11.2	Inspection
11.3	UC07/08 Host Adapter Setup (both models)
4.4	Installing the UC07/08-III in the MicroVAX III
4.5	Installing the UC07/08 in the MicroVAX II and LSI-11
4.6	Operation

The installation subsections do not contain every step necessary for bringing up the system. An Installation Checklist for each model outlines the process at the beginning of each installation subsection.

If you are unfamiliar with the subsystem installation procedure, Emulex recommends reading this Installation Section before beginning.

The UC07/08 is software transparent to DEC MSCP and TMSCP drivers under MicroVMS and Ultrix-32m. Refer to DEC software documentation for sysgen, addressing, and other information.

4.1.1 Subsystem Configurations

This section is limited to switch setting data and physical installation instructions. No attempt is made to describe the many subsystem configurations that are possible.

When you are installing the subsystem, you should make a record of the subsystem configuration and environment. Figure 11-1 is a Configuration Record Sheet that lists the information required and shows where the data can be found. This information will be of help to an Emulex service representative should your subsystem require service.

UC07/08 CONFIGURATION REFERENCE SHEET

GENERAL INFORMATION

1. Host computer type ______________________________
2. Host computer operating system ______________________________
   Version ______________

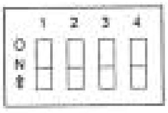
	Port 1 (UC07 and UC08)	Port 2 (UC08 only)
3. Subsystem Model	______________	______________
Controller(s)	______________	______________
	______________	______________
	______________	______________
Peripheral(s)	______________	______________
	______________	______________
	______________	______________

UC07/08 CONFIGURATION

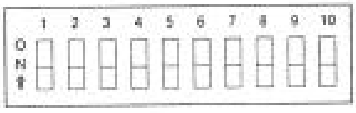
1. Warranty expiration date ______________________________
2. Top assembly number ______________________________
3. Serial number ______________________________

	Port 1 (UC07 and UC08)	Port 2 (UC08 only)
4. Firmware revision number	______________	______________
5. Q-bus address	______________	______________
6. Interrupt vector address	______________	______________
7. Emulation (MSCP or TMSCP)	______________	______________

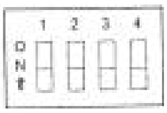
8. Switch settings (☐ = OFF ■ = ON)



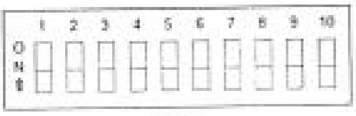
SW1



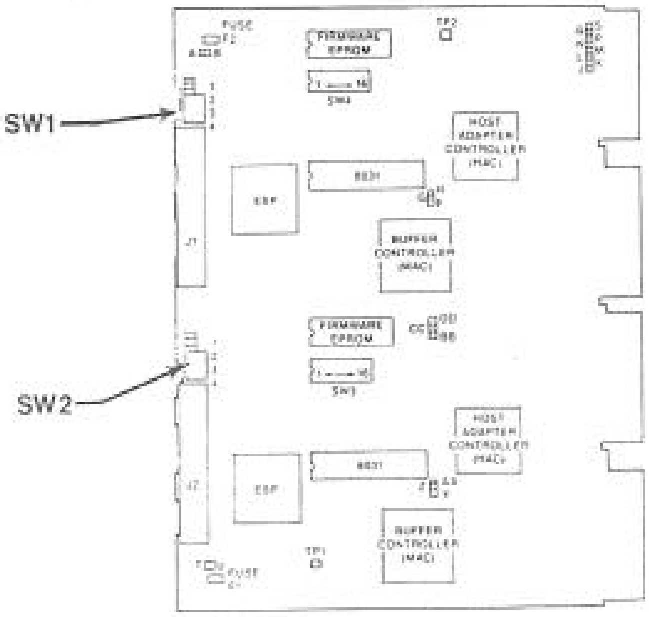
SW4



SW2



SW3



U26 label identifies top assembly and serial numbers.
U29 label identifies Port 1 firmware revision. U22 label identifies Port 2 firmware revision.
Use Pencil

Figure 4–1. UC07/08 Configuration Reference Sheet

4.2 Inspection

Emulex products are shipped in special containers designed to provide full protection under normal transit conditions. Immediately upon receipt, the shipping container should be inspected for evidence of possible damage incurred in transit. Any obvious damage to the container, or indications of actual or probable equipment damage, should be reported to the carrier company in accordance with instructions on the form included in the container.

Unpack the UC07/08 subsystem and, using the shipping invoice, verify that all equipment is present. Verify also that model or part numbers (P/N), revision levels, and serial numbers agree with those on the shipping invoice. These verifications are important to confirm warranty. If evidence of physical damage or identity mismatch is found, notify an Emulex representative immediately. If the equipment must be returned to Emulex, it should be shipped in the original container.

Visually inspect the UC07/08 Host Adapter after unpacking. Check for such items as bent or broken connector pins, damaged components, or any other evidence of physical damage.

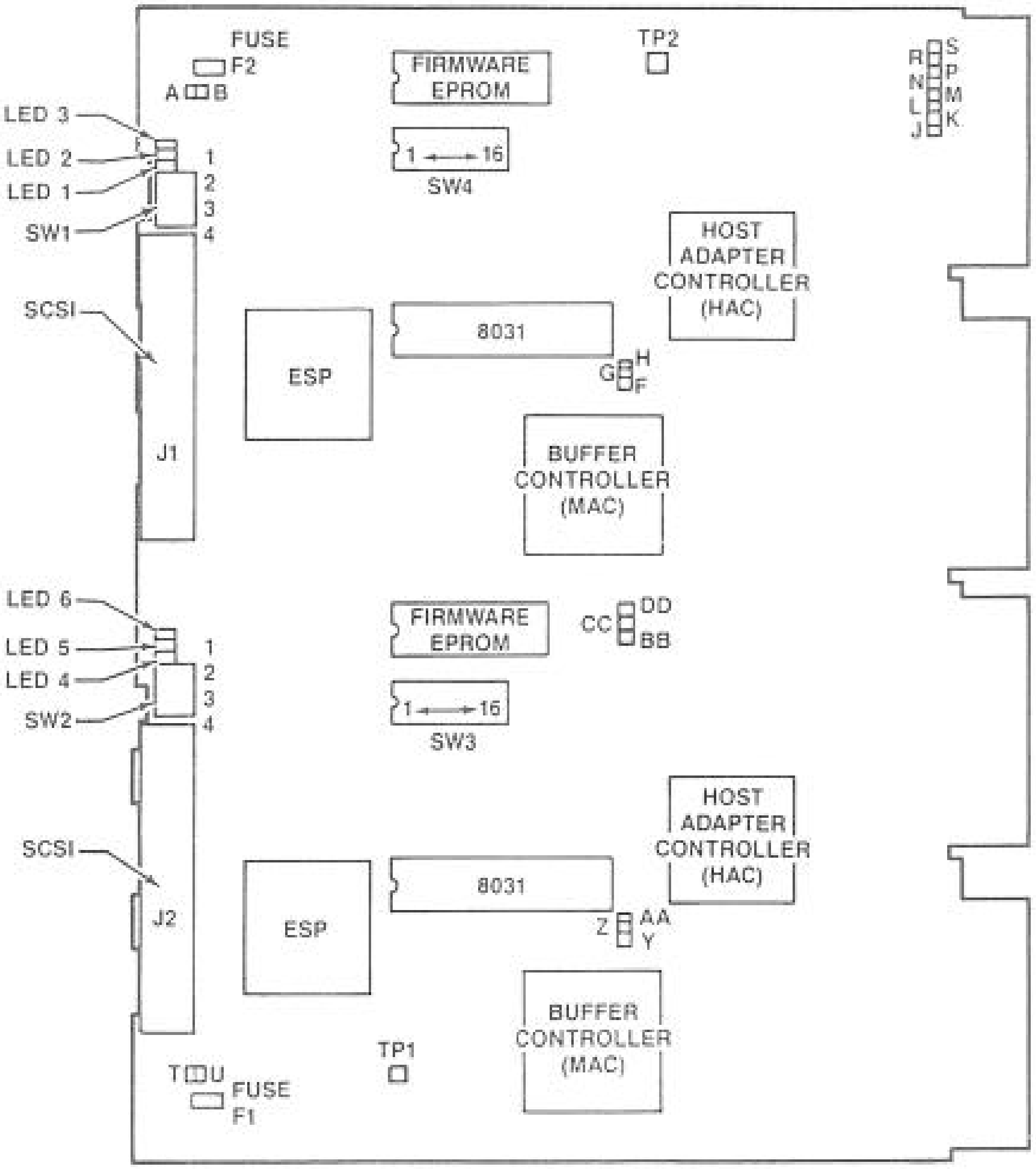
Examine all socketed components carefully to ensure that they are properly seated.

4.3 Host Adapter Setup

Before installing the UC07/08, you must set the Q-bus address and emulation type. Since a UC08 includes two separate host adapters on a single board, you have to set the address and emulation for both adapters. Since it is necessary to differentiate between settings for the two adapters, we will call the adapter associated with the SCSI connector labeled J1, Port 1, and the adapter associated with connector J2, Port 2. If you have a UC07, you can ignore all references to Port 2.

There are two versions of both the UC07 and UC08, one for use in LSI-11 and MicroVAX II applications and the other for use in MircoVAX III systems. The MicroVAX III version has a substantial "handle" on the outside edge of the board and is called a UC07-III or UC08-III. The configuration of both the plain and -III versions are the same.

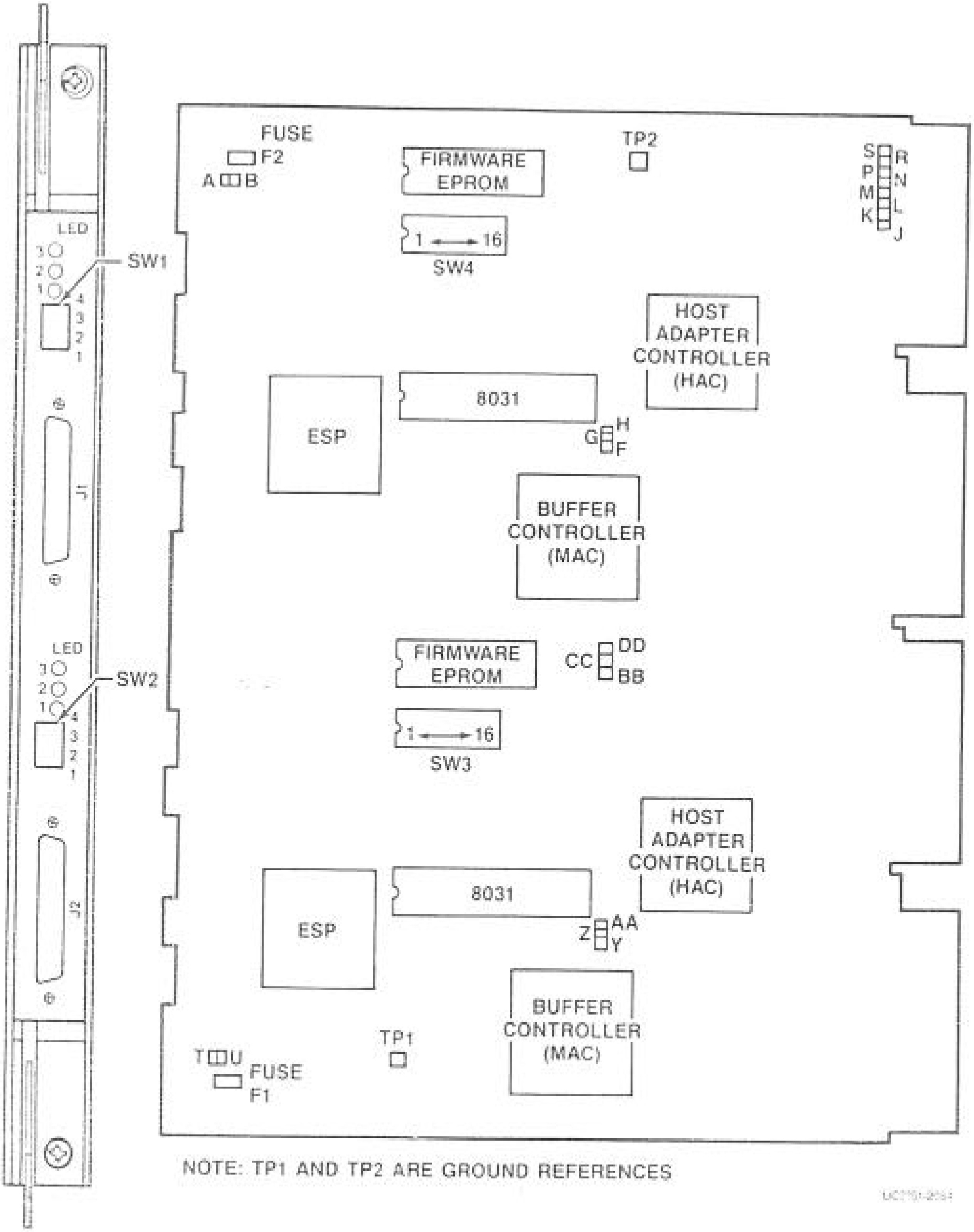
Figure 11–2 shows the locations of the configuration switches, connectors, and jumpers on the UC07/08; Figure 11–3 shows the same items on the UC07/08-III. The two figures also give the factory settings for all jumpers on the UC07/08. Jumpers that are installed at the factory are shown shaded in the two figures.



NOTE: TP1 AND TP2 ARE GROUND REFERENCES

UC0701-2053

Figure 4–2. UC07/08 Host Adapter Assembly



NOTE: TP1 AND TP2 ARE GROUND REFERENCES

Figure 4–3. UC07/08-III Host Adapter Assembly

Table 4-1 defines the function and factory configuration of all switches on the UC07/08 adapter.

Table 4–1. UC06/07/08 Switch Definitions and Factory Configuration

Switch	OFF(0)	ON(1)	Fact	Function	Section
Port 1 (J1)					
SW1-1	Run	Reset/Halt	OFF(0)	Run vs. Reset/Halt	6.4
SW1-2	Enable	Disable	OFF(0)	Fast File Search (Tape only)	4.3.6
SW1-3	Enable	Disable	OFF(0)	SCSI Reset (Tape only)	4.3.7
SW1-4	Normal	Loop	OFF(0)	Loop on Self-Test Error	
SW4-1	–	–	OFF(0)	Host Adapter Q-bus Address	11.3.2
SW4-2	–	–	OFF(0)	Host Adapter Q-bus Address	11.3.2
SW4-3	–	–	OFF(0)	Host Adapter Q-bus Address	11.3.2
SW4-4	–	–	OFF(0)	Host Adapter Q-bus Address	11.3.2
SW4-5	TMSCP	MSCP	ON(1)	Emulation	11.3.1
SW4–6	Disable	Enable	OFF(0)	Autoboot (MSCP only)	4.3.4
SW4-7	–	–	OFF(0)	Reserved	
SW4-8	–	–	OFF(0)	Reserved	
SW4-9	–	–	OFF(0)	Reserved	
SW4-10	–	–	OFF(0)	Reserved	
Port 2 (J2)					
SW2-1	Run	Reset/Halt	OFF(0)	Run vs. Reset/Halt	6.4
SW2-2	Enable	Disable	OFF(0)	Fast File Search (Tape only)	4.3.6
SW2-3	Enable	Disable	OFF(0)	SCSI Reset (Tape only)	4.3.7
SW2-4	Normal	Loop	OFF(0)	Loop on Self-Test Error	
SW3-1	–	–	OFF(0)	Host Adapter Q-bus Address	11.3.2
SW3-2	–	–	OFF(0)	Host Adapter Q-bus Address	11.3.2
SW3-3	–	–	OFF(0)	Host Adapter Q-bus Address	11.3.2
SW3-4	–	–	OFF(0)	Host Adapter Q-bus Address	11.3.2
SW3-5	TMSCP	MSCP	ON(1)	Emulation	11.3.1
SW3-6	Disable	Enable	OFF(0)	Autoboot (MSCP only)	4.3.4
SW3-7	–	–	OFF(0)	Reserved	
SW3-8	–	–	OFF(0)	Reserved	
SW3-9	–	–	OFF(0)	Reserved	

(Continued on next page)

Table 4–1. UC06/07/08 Switch Definitions and Factory Configuration

Switch	OFF(0)	ON(1)	Fact	Function	Section
SW3-10	–	–	OFF(0)	Reserved	

ON(1) = Closed
OFF(0) = Open

Reserved switches must be left OFF
Fact = Factory switch setting

NOTE: If you change a switch position on the UC07/08 or change configuration values in NOVRAM, you must also reset the UC07/08 so that the adapter's initialization sequence reads the codes established by the switch settings and/or NOVRAM. To reset the UC07/08, either toggle (ON then OFF) switch SW1-1 (SW2-1 for Port 2), or power-down and power-up the system.

4.3.1 Emulation

Each host adapter on the UC07/08 is capable of performing one of two emulations: MSCP to support disk devices, and TMSCP to support tape devices. Select the appropriate emulation for your application. See Table 11-2 for switch setting information.

Table 4–2. Emulation Selection

Port	Switch	OFF	ON	Function
1	SW4-5	TMSCP	MSCP	Emulation
2	SW3-5	TMSCP	MSCP	Emulation

4.3.2 Host Adapter Bus Address

Every Q-Bus I/O device has a block of several registers through which the system can command and monitor that device. The registers are addressed sequentially from a starting address assigned to that device, in this case an MSCP or TMSCP host adapter.

The starting address for the host adapter associated with Port 1 (J1) is selected using switches SW4-1 through SW4-4. When there is a second host adapter (Port 2) on the board (UC08), its address is selected using SW3-1 through SW3-4.

CAUTION! For UC08 and UC08-III boards, both Port 1 and Port 2 must not be set to the same host adapter bus address.

4.3.2.1 Disk (MSCP) Emulations

The address selected by the address switches varies depending on the emulation selected. Table 11-3 lists the addresses and switch settings for MSCP emulations. The standard address for MSCP devices is 17772150, which is typically assigned to the first MSCP-type device on a system.

For more information on determining the Q-Bus address, refer to the DEC operating system and MicroVAX 3500/3600 system documentation.

Table 4–3. MSCP Emulation Bus Address Settings

Port 1 (J1)					Port 2 (J2)				
Bus Address (in octal)	— SW4 — 4	3	2	1	Bus Address (in octal)	— SW3 — 4	3	2	1
17772150	0	0	0	0	17772150	0	0	0	0
~~17772154~~	~~0~~	~~0~~	~~0~~	~~1~~	~~17772154~~	~~0~~	~~0~~	~~0~~	~~1~~
17760334	0	0	1	0	17760334	0	0	1	0
17760340	0	0	1	1	17760340	0	0	1	1
17760344	0	1	0	0	17760344	0	1	0	0
17760350	0	1	0	1	17760350	0	1	0	1
17760354	0	1	1	0	17760354	0	1	1	0
17760360	0	1	1	1	17760360	0	1	1	1
17760364	1	0	0	0	17760364	1	0	0	0
17760370	1	0	0	1	17760370	1	0	0	1
17760374	1	0	1	0	17760374	1	0	1	0
17760400	1	0	1	1	17760400	1	0	1	1
17760404	1	1	0	0	17760404	1	1	0	0
17760410	1	1	0	1	17760410	1	1	0	1
17760414	1	1	1	0	17760414	1	1	1	0
17760420	1	1	1	1	17760420	1	1	1	1

4.3.2.2 Tape (TMSCP) Emulations

The address selected by the address switches varies depending on the emulation selected. Table 11-4 lists the addresses and switch settings for TMSCP emulations.

The standard address for TMSCP devices is 17774500, which is typically assigned to the first TMSCP-type device on a system.

For more information on determining the Q-Bus address, refer to DEC operating system and MicroVAX 3500/3600 system documentation.

Table 4–4. TMSCP Emulation Bus Address Settings

Port 1 (J1)					Port 2 (J2)				
Bus Address (in octal)	--- SW4 ---				Bus Address (in octal)	--- SW3 ---			
	4	3	2	1		4	3	2	1
17774500	0	0	0	0	17774500	0	0	0	0
17760404	0	0	0	1	17760404	0	0	0	1
17760410	0	0	1	0	17760410	0	0	1	0
17760414	0	0	1	1	17760414	0	0	1	1
17760444	0	1	0	0	17760444	0	1	0	0
17760450	0	1	0	1	17760450	0	1	0	1
17760454	0	1	1	0	17760454	0	1	1	0
17760504	0	1	1	1	17760504	0	1	1	1
17760510	1	0	0	0	17760510	1	0	0	0
17760514	1	0	0	1	17760514	1	0	0	1
17760520	1	0	1	0	17760520	1	0	1	0
17760524	1	0	1	1	17760524	1	0	1	1
17760530	1	1	0	0	17760530	1	1	0	0
17760534	1	1	0	1	17760534	1	1	0	1
17760540	1	1	1	0	17760540	1	1	1	0
17760544	1	1	1	1	17760544	1	1	1	1

4.3.3 Interrupt Vector Address

The interrupt vector address for the UC07/08 is programmed into the device by the operating system during the MSCP initialization sequence.

4.3.4 Autoboot (LSI-11 Only)

The UC07/08 has an autoboot feature which you can enable for Port 1 or Port 2 using switches as described in Table 4–5. See subsection 5.5.1.6 for a complete description of this option.

Table 4–5. Autoboot

Port	Switch	OFF	ON	Function
1	SW4-6	Disable	Enable	Autoboot
2	SW3-6	Disable	Enable	Autoboot

4.3.5 Interrupt Priority Level

The UC07/08 is factory configured for interrupt request (IRQ) level 4 (BR4). This is the preferred configuration for most DEC Q-Bus systems. In the case of special applications, the user may change to IRQ5 (BR5) via jumpers. Table 4–6 below describes the different jumper settings. If you use IRQ5, Emulex strongly recommends that the UC07/08 be located ahead of all DEC devices on the bus.

Table 4–6. Interrupt Priority Level Quad-wide

Port	Jumper	BR4 (Factory)	BR5
1	P-R R-S	IN OUT	OUT IN
2	L-M M-N	IN OUT	OUT IN

Table 4-7. Interrupt Priority Level Dual-wide (UC06/07D)

UC06 JP7	BR4 (Factory)	UC07/D Jumper	BR4 (Factory)	BR5	
				UC06	UC07
1-2	OUT	T-U	IN	IN	OUT
2-3	IN	V-U	OUT	OUT	IN

4.3.6 Fast File Search Switch

The UC07/08 is factory configured to enable fast file search mode on the attached EXABYTE drive. In this mode, all software SPACE FILE MARK commands are sent unmodified directly to the tape drive. If the command is for the forward direction, the drive spaces forward at high speed the number of file marks specified in the command. However, because the EXABYTE cannot read while it is in high speed, the UC07/08 cannot keep track of the number of individual records that have been spaced over.

Although not usual, it is quite possible for an application program to request that the TMSCP tape device indicate its position on tape by maintaining a count of how many records from BOT it is on the tape. If your application requires this type of position tracking, it might be necessary for you to disable fast file search by turning SW1-2 to the ON position. When fast file search is disabled, the UC07/08 converts all SPACE FILE MARK commands to SPACE RECORD commands. This enables the UC07/08 to keep track of the exact number of records spaced over.

Emulex has verified that normal VMS/RSX utilities work correctly with fast file search enabled. Note that certain operating systems have demonstrated incompatibility with Fast File Search mode and might require that you disable the feature for proper operation.

4.3.7 Disable SCSI Resets

The UC07 is factory set to enable SCSI bus resets when used in TMSCP mode. This allows the controller to issue a bus reset to tape devices that are not responding properly, a condition which could happen periodically. If the UC07 is used in a multi-initiator mode (two or more controllers on the same SCSI bus), then you must disable SCSI resets from occurring so tape operations are not affected during system startup, shutdowns, or interruptions from other controllers. SCSI resets are already disabled for MSCP (disk) operations to allow dual hosts on the SCSI bus.

4.4 Installing the UC07/08-III in the MicroVAX III

This subsection describes the physical installation of the UC07/08-III Host Adapter in DEC's MicroVAX 3500 and 3600. You should have already completed steps 1 and 2 on the following Installation Checklist:

INSTALLATION CHECKLIST

☐ 1. Inspect the UC07/08-III Host Adapter (subsection 4.2).

☐ 2. Set up the switches and jumpers on the UC07/08-III module (subsection 4.3).

☐ 3. Install the adapter in the MicroVAX 3500/3600 backplane.

☐ 4. Install the UC07/08-III Distribution Panel in the rack-mount cabinet and connect to the UC07/08-III PCBA.

☐ 5. Install and connect the disk or tape controller(s) to the UC07/08-III Distribution Panel.

☐ 6. Run the onboard embedded diagnostics. (This step includes formatting the disk drives.)

☐ 7. Bring the system up.

4.4.1 Maintaining FCC Class A Compliance

Emulex has tested the UC07/08-III Intelligent Host Adapter with DEC computers that comply with FCC Class A limits for radiated and conducted interference. When properly installed, the UC07/08-III does not cause compliant computers to exceed Class A limits.

The UC07/08-III Host Adapter subsystem has only one physical configuration. The UC07/08-III PCBA is installed in the MicroVAX 3500/3600 cabinet and the UC07/08 Distribution Panel and disk drives are mounted in a separate rack-mount cabinet.

To limit radiated interference, DEC completely encloses the components of its computers that generate or could conduct radio-frequency interference (RFI) with a grounded metal shield (earth ground). During installation of the UC07/08-III, nothing must be done that would reduce this shield's effectiveness. That is, when the UC07/08-III installation is complete, no gap in the shield that would allow RFI to escape can be allowed.

Conducted interference is generally prevented by installing a filter in the AC line between the computer and the AC outlet. Most power distribution panels that are of current manufacture contain suitable filters.

4.4.2 Physically Installing the UC07/08-III PCBA

The following subsections describe the physical installation of the UC07/08-III Host Adapter PCBA.

4.4.2.1 System Preparation

To prepare the MicroVAX 3500/3600 to accept the UC07/08- III, use the following procedure:

1. Power down the system by switching OFF the main power switch.
2. Open the front chassis door.
3. Remove a blank cover from the front of the chassis so that an empty slot is exposed.

4.4.2.2 Slot Selection

The UC07/08-III may be assigned to any desired slot because it uses the Q-Bus four-level interrupt scheme to perform distributed interrupt arbitration.

There must be no unused slots between the CPU and the UC07/08-III.

4.4.2.3 Mounting

Plug the UC07/08-III into the MicroVAX 3500/3600 backplane with components oriented in the same direction as the CPU and other modules. Always insert and remove the boards with the computer power OFF to avoid possible damage to the circuitry.

The UC07/08-III PCBA includes a front panel with extractor handles. To install the board, slide the board in the slot with the extractor handles in the open position (aligned with the front panel of the PCBA). See Figure 4-4. When the board is properly positioned in the throat of the bus connectors, seat the board by pushing the extractor handles towards the center of the front panel.

The front panel of the UC07/08 PCBA might be set back further than the panels of the DEC boards in the backplane. Install a gap-filler panel on either side of the UC07/08-III, between a flat-board cover and the front panel of the UC07/08-III. (Each UC07/08-III is shipped with two gap-filler panels; refer to Tables 1-3 and 1-4 for part numbers.)

Use a Philips head screwdriver and push and turn the handle-locking screws a quarter-turn to lock the UC07/08-III PCBA into the chassis.

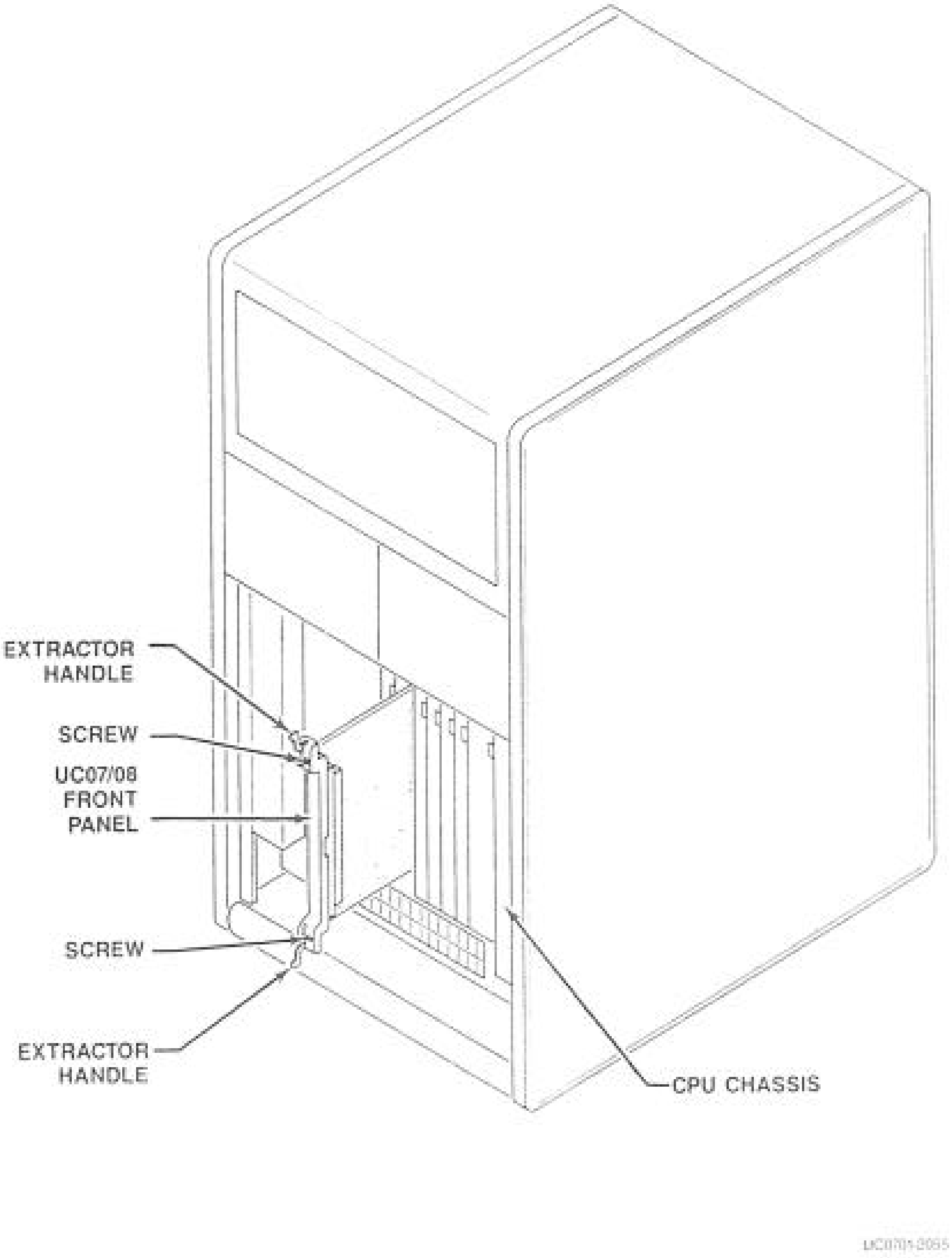


Figure 4–4. Mounting the UC07/08-III PCBA in a MicroVAX 3500/3600

4.4.2.4 SCSI Controller Preparation

The SCSI controllers attached to the UC07/08 Host Adapter must be configured to work with the adapter. Generally, there are five variables which must be considered:

- The controller's SCSI bus address
- SCSI bus parity generation and checking
- SCSI bus disconnect/reconnect capability
- SCSI bus synchronous data transfer support
- Drive LUN and parameters

Every controller and host adapter on a given SCSI bus must have a unique address. (Remember that with the UC08, you have two separate SCSI ports and thus can have two separate buses.) The range of addresses available is from 0 to 7. Traditionally, the following addresses are assigned to the various devices on a SCSI bus:

Host Adapter	7
First Target Device	0
Second Target Device	1

These assignments are arbitrary, but the adoption of such a scheme ensures that no two devices are accidentally assigned the same number.

During your configuration of the UC07/08's NOVRAM (Section 5), you will be required to specify the both the host adapter's SCSI address and the SCSI address(es) of the controllers which it is to support. Select addresses for those controllers now and configure them accordingly. See the manufacturer's manual for instructions.

The UC07/08 always generates parity during SCSI bus transfers. If parity checking is an optional feature of your SCSI controller, enable it now. If your controller can not generate parity (presumably it will also not check parity, but that does not matter), you must disable the UC07/08's parity checking feature when you load the NOVRAM. See subsections 5.5.1.4 and 5.6.2.2.

The UC07/08 supports the SCSI disconnect/reconnect feature, which allows the target of a SCSI command to logically disconnect from the initiator while processing the command. This frees the SCSI bus for other operations and thus increases performance.

If the controller you are using supports this feature, enable it (if necessary) now. You will also have to enable the UC07/08's support of this feature when you are loading its NOVRAM (see subsections 5.5.1.25 and 5.6.2.2).

The UC07/08-III supports synchronous SCSI data transfers. If your SCSI device supports this feature, refer to the device's manual and take the steps necessary to enable it.

As every controller and host adapter on the SCSI bus must have a unique address, so too must each drive on a controller have a unique Logical Unit Number (LUN). If the drive has an embedded SCSI controller, then its LUN is always 0. However, if your controller supports more than one drive (as with Emulex's MD25, which supports four), you will have to assign each drive a unique LUN starting with 0 (or one if that is the number lowest number available for that drive type; the controller will still refer to it as LUN 0). Assign additional drives sequential addresses (i.e., 0, 1, 2, ...).

Each drive will have some unique characteristics which will have to be reported to the UC07/08 when you load its NOVRAM. The UC07/08 will identify the drive by its controller's SCSI address and LUN.

4.4.2.5 Subsystem Placement

Place and install the controller and drive assemblies according to the manufacturer's instructions. Position the subsystems in their final places before beginning the installation of the UC07/08. This positioning allows the I/O cable routing and length to be accurately judged.

4.4.3 Cabling

In a UC07/08-III subsystem, the UC07/08-III PCBA is installed in the MicroVAX 3500/3600 cabinet and the SCSI subsystem is mounted in a separate cabinet. The UC07/08-III interfaces with the SCSI device(s) it controls using one or two 50-conductor round shielded cables, the UC07/08-III Distribution Panel, and one or two 50-conductor flat-ribbon cables. Whether one or two cables are required depends on whether a UC07 or UC08 is being installed. For the rest of this discussion, we will assume a two SCSI bus system is being installed. If not, ignore references to the Port 2 system (UC08 J2).

The two round-shielded cables are connected from the high-density connectors J1 and J2 on the UC07/08-III PCBA front panel to the 50-pin connectors J1 IN and J2 IN (respectively) on the front side of the UC07/08-III Distribution Panel. From connectors J3 OUT and J4 OUT on the back side of the UC07/08-III Distribution Panel, two 50-conductor flat-ribbon cables attach to connectors on the first SCSI controller on the SCSI bus. Maximum cable length (cumulative) for the UC07/08-III is 6 meters; for the UC06, 20 meters is the maximum length. Figure 4-5 is a basic cabling diagram.

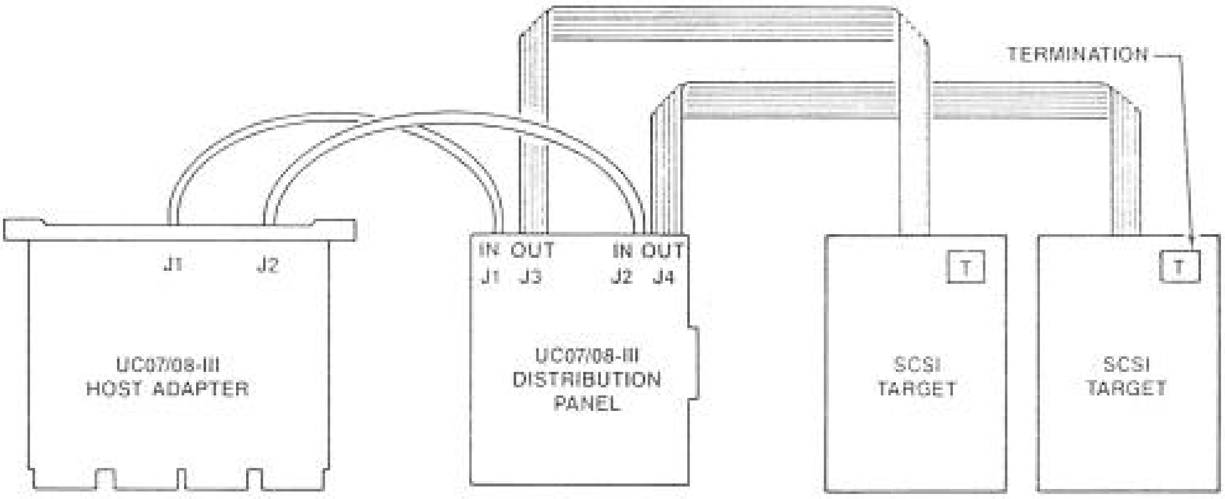


Figure 4–5. Basic Cabling

Because the UC07/08-III PCBA and the SCSI subsystems are located in separate cabinets, the cables that run between the cabinets are shielded. The points of cabinet exit and entry must not cause the computer installation to exceed FCC limits for RFI. The UC07/08- III Distribution Panel, rack-mount panel, and roundshielded cables designed for this purpose are available from Emulex (subsection 1.3). The UC07/08-III Distribution Panel (Figure 4-6) is designed to fit directly into a rack-mount panel which installs in any standard 19-inch RETMA rack. The rack-mount panel is shown in Figure 4–7.

Procedure:

1. Ensure the UC07/08-III PCBA is installed in the backplane of the MicroVAX 3500/3600 and that the system power is OFF.
2. Remove two of the four small panels from one side of the rack-mount panel (Figure 4–7). Install a UC07/08-III Distribution Panel (Figure 4–6) in the resulting aperture and secure it with the four captive screws. Tighten the screws finger-tight. Make sure that no gaps are present around the UC07/08-III Distribution Panel.

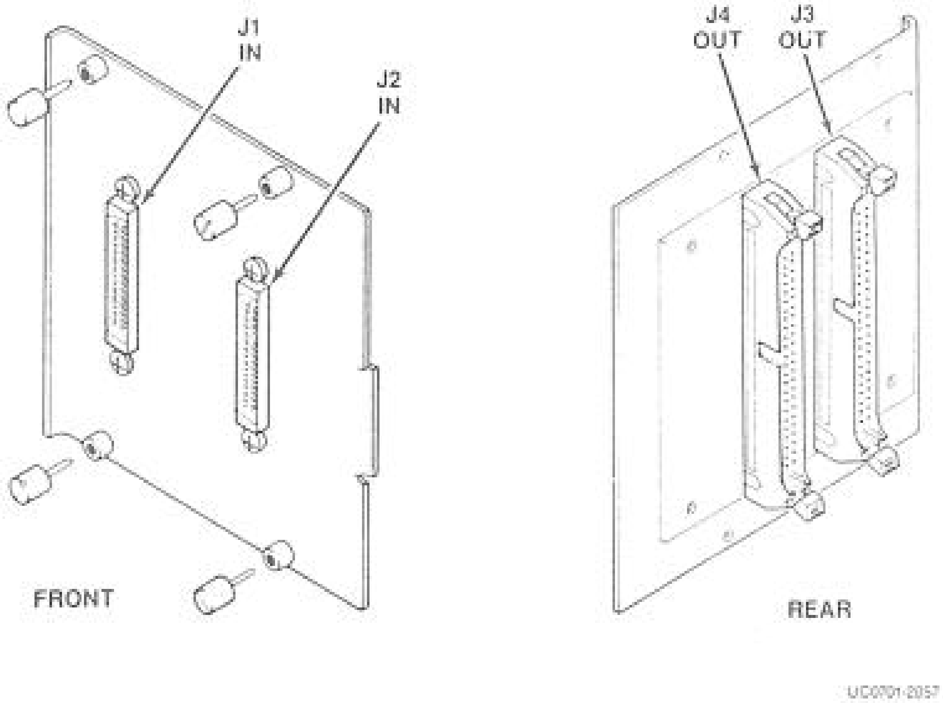


Figure 4–6. UC07/08-III Distribution Panel

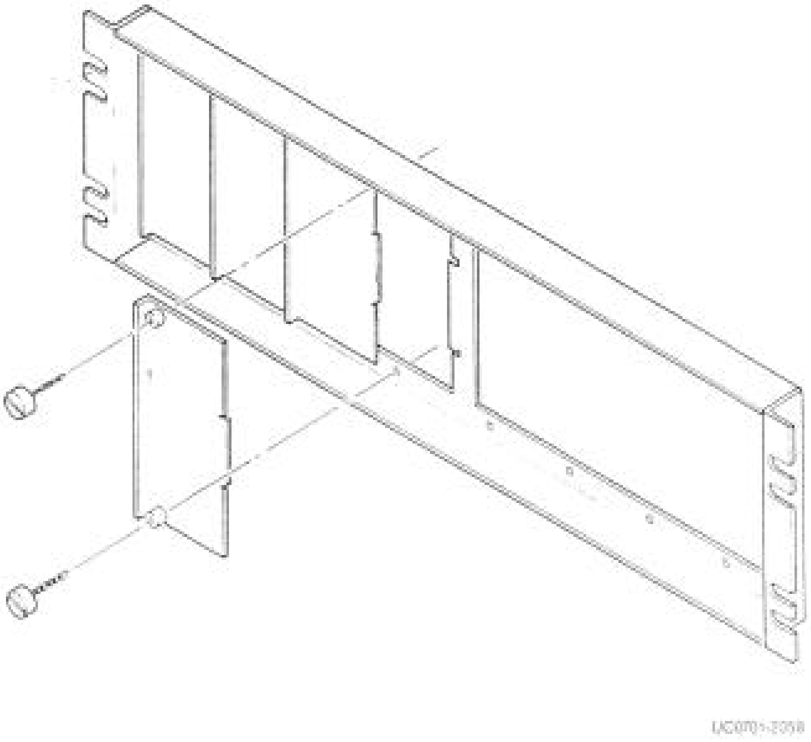


Figure 4–7. Rack-Mount Panel

3. Install the rack-mount panel containing the UC07/08-III Distribution Panel in the RETMA rack in the transport cabinet (Figure 4-8).
4. Connect the round-shielded cables from the UC07/08-III PCBA to the Distribution Panel. Align the top of the cable header on the first round-shielded cable (the cable runs out the bottom) with the top of the high-density connector J1 on the front panel of the UC07/08-III PCBA. Hold in the latch on the top of the cable header and press the header into J1; connect the header at the other end to connector J1 IN on the front side of the UC07/08-III Distribution Panel. Repeat for the second round-shielded cable from J2 on the UC07/08-III PCBA to connector J2 IN on the UC07/08-III Distribution Panel.
5. Connect the flat-ribbon cables from the UC07/08-III Distribution Panel to the SCSI controller in the disk or tape subsystem. Align the molded arrow on the cable header of the first flat-ribbon cable with pin 1 of connector J3 OUT on the back side of the UC07/08-III Distribution Panel. Press the header into J3 OUT; attach the header at the other end of the cable to the appropriate connector SCSI controller. Repeat for the second flat-ribbon cable from J4 OUT on the UC07/08-III Distribution Panel to the appropriate connector on the second SCSI subsystem. Make sure that the latches on the connector fully engage the cable header.

End of Procedure

4.4.3.1 Termination

SCSI buses are terminated at each end. The UC07/08-III provides termination for one end of the cable. The last SCSI device on the bus must likewise terminate the bus; however, controllers daisy chained between the UC07/08 and last controller on the bus must have their terminators removed. See the controller or subsystem manufacturer's documentation for instructions in installing or removing terminators.

4.4.3.1.1 Termination Power

The UC07/08-III can be configured to provide termination power to the terminator at the opposite end of the SCSI bus. This feature might be required in certain applications in which the SCSI device at the opposite end of the SCSI bus cannot provide termination for the SCSI bus. The UC07-III can provide power to a remote termination circuit by placing jumper A–B IN. On the UC08-III, this feature is enabled by placing jumper A–B IN for Port 1 (connector J1) or placing jumper T–U IN for Port 2 (connector J2). The factory setting is OUT for both of these jumpers. When the UC06 is shipped, JP2 is installed and JP1, pins 2 to 3, are jumpered. To enable "termination power" move the jumper on JP1 to pins 1 and 2. Emulex recommends the use of keyed connectors in applications where the UC07/08-III provides terminator power. This will prevent accidental grounding or misconnection of termination power

The termination power on the UC07/08-III has the following characteristics:

- 4.75 volts DC to 5.25 volts DC
- Fused at 1 ampere (Fuses: F1 and F2)
- Diode to prevent backflow of power into the UC07/08-III
- Jumpers to enable or disable this feature

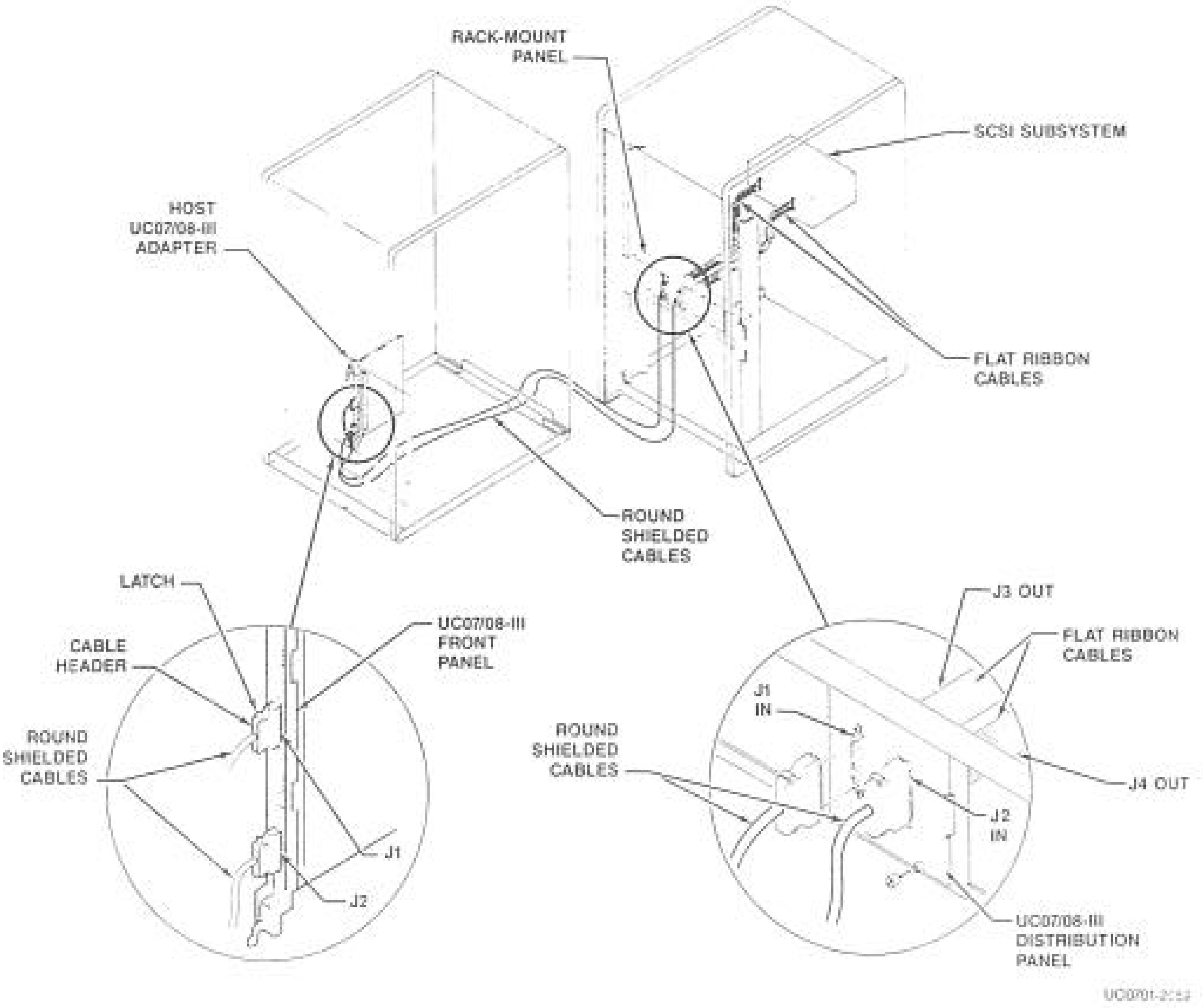


Figure 4–8. UC07/08-III Subsystem Cabling

4.5 Installing the UC07/08 in the MicroVAX II and LSI-11

This subsection describes the physical installation of the UC07/08 Host Adapter in DEC's MicroVAX II and LSI-11 systems. You should have already completed steps 1 and 2 on the following Installation Checklist:

UC07/08 INSTALLATION CHECKLIST

☐ 1. Inspect the UC07/08 Host Adapter (subsection 4.2).

☐ 2. Set up the swi6tches and jumpers on the UC07/08 module (subsection 4.3).

☐ 3. Install the adapter in the Q-Bus backplane.

☐ 4. Install or connect the the disk or tape controller(s) to the UC07/08.

☐ 5. Run the onboard embedded diagnostics. (This step includes formatting the disk drives.)

☐ 6. Bring the system up.

4.5.1 Maintaining FCC Class A Compliance

Emulex has tested the UC07/08 Intelligent Host Adapter with DEC computers that comply with FCC Class A limits for radiated and conducted interference. When properly installed, the UC07/08 does not cause compliant computers to exceed Class A limits.

The UC07/08 Host Adapter may be installed in a large number of configurations, with its associated SCSI subsystems in the same cabinet as the CPU and UC and with the subsystem in a separate cabinet.

When the SCSI subsystem and UC07/08 are located in the same cabinet, they may connected using unshielded, 50-wire cables.

When the SCSI subsystem and the UC07/08 are located in separate cabinets, you must use shielded cables for the transition between the two cabinets. Also, the areas where the cable enter and leave the CPU and subsystem cabinets must be constructed so as not to destroy the cabinets RFI shielding capability. See below. For such installations, it is the customer's sole responsibility to ensure that FCC Class A compliance is maintained by the system with the UC07/08 installed.

To limit radiated interference, DEC completely encloses the components of its computers that generate or could conduct radio-frequency interference (RFI) with a grounded metal shield (earth ground). During installation of the UC07/08, nothing must be done that would reduce this shield's effectiveness.

That is, when the UC07/08 installation is complete, no gap in the shield that would allow RFI to escape can be allowed.

Conducted interference is generally prevented by installing a filter in the AC line between the computer and the AC outlet. Most power distribution panels that are of current manufacture contain suitable filters.

4.5.2 Physically Installing the UC07/08 PCBA

The following subsections describe the physical installation of the UC07/08 Host Adapter PCBA.

4.5.2.1 System Preparation

To prepare the MicroVAX II or LSI-11 to accept the UC07/08, use the following procedure:

LSI-11 and MicroVAX II Preparation:

1. Power down the system by switching OFF the main AC breaker.
2. Remove the rear cover from the chassis so that the patch panel is exposed. The rear cover is held on by snap pads. Grasp the cover at the top and bottom, and pull straight back.
3. Loosen the captive screws from the patch panel using a standard screwdriver.
4. Remove the patch panel.
5. Find the flat-ribbon cable that connects the CPU module to the patch panel. For easier board installation, you may disconnect the CPU flat-ribbon cable from the patch panel.

LSI-11 Series Preparation:

1. Power down the system by switching OFF the main AC breaker.
2. Remove the cover from the chassis so that the backplane is exposed. Do not replace the covers or patch panels until the installation is verified (Section 5).

4.5.2.2 Slot Selection

The UC07/08 may be assigned to any desired slot because it uses the Q-Bus four-level interrupt scheme to perform distributed interrupt arbitration.

There must be no unused slots between the CPU and the UC07/08.

4.5.2.3 Mounting

The UC07/08 Host Adapter should be plugged into the Q-Bus backplane with components oriented in the same direction as the CPU and other modules. Always insert and remove the boards with the computer power OFF to avoid possible damage to the circuitry. Be sure that the board is properly positioned in the throat of the board guides before attempting to seat the board by pressing it into place.

4.5.2.4 SCSI Controller Preparation

The SCSI controllers attached to the UC07/08 Host Adapter must be configured to work with the adapter. Generally, there are five variables which must be considered:

- The controller's SCSI bus address
- SCSI bus parity generation and checking
- SCSI bus disconnect/reconnect capability
- SCSI bus synchronous data transfer support
- Drive LUN and parameters

Every controller and host adapter on a given SCSI bus must have a unique address. (Remember that with the UC08, you have two separate SCSI ports and thus can have two separate buses.) The range of addresses available is from 0 to 7. Traditionally, the following addresses are assigned to the various devices on a SCSI bus:

Host Adapter	7
First Disk Controller	0
Second Disk Controller	1
First Tape Controller	4

These assignments are arbitrary, but the adoption of such a scheme ensures that no two devices are accidentally assigned the same number. In MSCP mode, each SCSI port can support a maximum of seven (7) SCSI target devices. Each SCSI target can support up to eight (8) LUNs; however, the maximum number of LUNs that can be attached to a SCSI port is eight (8).

During your configuration of the UC07/08's NOVRAM (Section 5), you will be required to specify both the host adapter's SCSI address and the SCSI address(es) of the controllers which it is to support. Select addresses for those controllers now and configure them accordingly. See the manufacturer's manual for instructions.

The UC07/08 always generates parity during SCSI bus transfers. If parity checking is an optional feature of your SCSI controller, enable it now. If your controller can not generate parity (presumably it will also not check parity, but that does not matter), you must disable the UC07/08's parity checking feature when you load the NOVRAM. See subsections 5.5.1.4 and 5.6.2.2.

The UC07/08 supports the SCSI disconnect/reconnect feature, which allows the target of a SCSI command to logically disconnect from the initiator while processing the command. This frees the SCSI bus for other operations and thus increases performance.

If the controller you are using supports this feature, enable it (if necessary) now. You will also have to enable the UC07/08's support of this feature when you are loading its NOVRAM (see subsections 5.5.1.4 and 5.6.2.2).

The UC07/08 supports synchronous SCSI data transfers. If your SCSI device supports this feature, refer to the device's manual and take the steps necessary to enable it.

As every controller and host adapter on the SCSI bus must have a unique address, so to must each drive on a controller have a unique Logical Unit Number (LUN). If drive has an embedded SCSI controller, then its LUN is always 0. However, if your controller supports more than one drive (as with Emulex's MD25, which supports four), you will have to assign each drive a unique LUN starting with 0 (or one if that is the number lowest number available for that drive type; the controller will still refer to it as LUN 0). Assign additional drives sequential addresses (i.e., 0, 1, 2, ...).

Each drive will have some unique characteristics which will have to be reported to the UC07/08 when you load its NOVRAM. The UC07/08 will identify the drive by its controller's SCSI address and LUN.

4.5.2.5 Subsystem Placement

Place and install the controller and drive assemblies according to the manufacturer's instructions. Position the subsystems in their final places before beginning the installation of the UC07/08. This positioning allows the I/O cable routing and length to be accurately judged.

4.5.3 Cabling

The UC07/08 is connected to SCSI controllers using a standard 50-wire flat cable with 50-pin headers. Connector J1 on the UC07/08 is SCSI Port 1 and J2 is SCSI Port 2. Connect these ports to the SCSI disk or tape subsystem that you intend to support with the UC07/08, observing proper cable orientation (pin 1 on J1 and J2 is marked with a triangle molded into the connector). The maximum cable length allowed is 6 meters.

4.5.3.1 Termination

SCSI buses are terminated at each end. The UC07/08 provides termination for one end of the cable. The last SCSI device on the bus must likewise terminate the bus; however, controllers daisy chained between the UC07/08 and last controller on the bus must have their terminators removed. See the controller or subsystem manufacturer's documentation for instructions in installing or removing terminators.

4.5.3.1.1 Termination Power

The UC07/08 can be configured to provide termination power to the terminator at the opposite end of the SCSI bus. This feature might be required in certain applications in which the SCSI device at the opposite end of the SCSI bus cannot provide termination for the SCSI bus. The UC07 can provide power to a remote termination circuit by placing jumper A-B IN. On the UC08, this feature is enabled by placing jumper A-B IN for Port 1 (connector J1) or placing jumper T-U IN for Port 2 (connector J2). The factory setting is OUT for both of these jumpers. Emulex recommends the use of keyed connectors in applications where the UC07/08 provides terminator power. This will prevent accidental grounding or misconnection of termination power.

The termination power on the UC07/08 has the following characteristics:

- 4.75 volts DC to 5.25 volts DC
- Circuit protected at 1 ampere (Location: F1 and F2)
- Diode to prevent backflow of power into the UC07/08
- Jumpers to enable or disable this feature

4.5.3.1.2 Dual-wide UC07 Installation

If you are installing a dual-wide UC07, refer to Appendix D for jumper definitions and alternative termination power options.

4.6 Operation

There are no operational instructions. The UC07/08 is ready for initialization as soon as its drives are integrated and tested.

4.6.1 Indicators

There are three light emitting diodes (LEDs) on the UC07/08. These LEDs are used for both diagnostics and for normal operations.

If switch SW1-1 is OFF, the UC07/08 executes a preliminary test at the following times:

- On power-up
- After a reset condition
- After a bus initialization
- After a write operation to the Initialization and Polling (IP) register (base address)

The self-test routine consists of two test sequences: preliminary and self-test. The preliminary test sequence exercises the 8031 microprocessor chip. When the UC07/08 successfully completes the preliminary test, LED3 illuminates indicating that the UC07/08 is waiting for the MSCP or TMSCP initialization sequence.

During the MSCP initialization sequence, initiated by host software control, the UC07/08 executes a self-test that exercises the buffer adapter functions of the ESP chip, the Host Adapter Adapter (HAC) chip and its associated circuitry, the onboard RAM, and the control memory PROM. If the UC07/08 passes this sequence of its self-test successfully, all the LED indicators on the UC07/08 are OFF.

If a fatal error is detected either during self-test or while the system is running, all three of the LED indicators are ON (illuminated). If the UC07/08 fails to pass its power-up self-tests, you can select a special diagnostic mode (switch SW1-4 or SW4-4 ON) which causes the LED indicators to display an error code. See Self-Test Error Reporting, in Section 6, TROUBLESHOOTING.

During normal operation, LED1 and LED2 flicker occasionally. These LEDs are used to indicate Q-Bus activity.